

ELECTRONICS

AUSTRALIA

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VIDEO, HIFI & COMPUTERS

SEPTEMBER 1982

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STEREO SYNTHESISER FOR VCRs

AUDAX COMPACT LOUDSPEAKER SYSTEM
COMPUTER FEATURE: CHOOSING A PRINTER
HOW TO BUILD AN ELECTRIC FENCE



What is your turntable's "warp factor"?*

You may not realize it but every record has some degree of warp. And no matter how slight, it can give your turntable fits.

Warp, along with off-centring, were the reasons why Sony invented Biotracer.

The continuously correcting action of the electronic Biotracer tonearm perfectly suspends the stylus in the record grooves with no tension resulting from the forces of gravity or lateral pressure.

Biotracer is featured on Sony's PS-X600 and X500 with the advantages of stifling low frequency resonance, expanding dynamic range and maximizing performance from any cartridge you use. Biotracer also suppresses peak tonearm resonance electronically within a range of 3dB.

The sole object of its design was to neutralize the effects of record warp and off-centring through microcomputer precision. Which Sony does with aplomb.



PS-X600

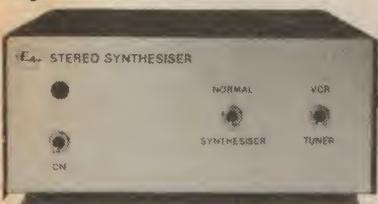
SONY®
THE ONE AND ONLY

ELECTRONICS AUSTRALIA

Volume 44, No. 9
September, 1982

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE

Stereo Synthesiser



Turn mono sound into stereo sound with this Stereo Synthesiser project. It uses just four ICs and is easy to build — see page 52.



Keep the cows (... err, bull) out of the cabbages with this electric fence project. We tell you how to build it on page 80.

COMING NEXT MONTH — Find out what's coming by turning to page 117.

On the cover

Our cover this month highlights two of our constructional projects: a Stereo Synthesiser for VCRs and a compact high-quality loudspeaker system from Audax. Note that the cover is conceptual only; the synthesiser must be used with a stereo amplifier.

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No other birth has created such an impression.



Epson printers

A whole new generation of Epson MX printers has just arrived. And while they share the family traits that made Epson famous—like unequalled reliability and ultra-fine printing—they've got a lot more of what it takes to be a legend.

For instance, they've got a few extra type styles. Sixty-six, to be exact, including italics, a handy subscript and superscript for scientific notation, and enough international symbols to print most Western languages.

What's more, on the new-generation MX-80, MX-80 F/T and MX-100, you get GRAFTRAX-Plus dot addressable graphics. Standard. So now you can have precision to rival plotters in a reliable Epson printer. Not to mention true back-space, software printer reset, and programmable form length, horizontal tab and right margin.

All in all, they've got the features that make them

destined for stardom. But the best part is that beneath this software bonanza beats the heart of an Epson. So you still get a bidirectional, logical seeking, disposable print head, crisp, clean, correspondence quality printing, and the kind of reliability that has made Epson the best-selling printers in the world.

All of which should come as no surprise, especially when you look at the family tree. After all, Epson invented digital printers almost seventeen years ago for the 1964 Tokyo Olympics. We were the first to make printers as reliable as the family stereo. And we introduced the computer world to correspondence quality printing and disposable print heads. And now we've given birth to the finest printers for small computers on the market.

What's next? Wait and see. We're already expecting.

EPSON

For further information contact your nearest Warburton Franki office

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PLAYMASTER QUALITY HI-FI FROM DICK SMITH

OUR
MOST
POPULAR
KIT EVER!

PLAYMASTER MOSFET AMPLIFIER

OVER
2,000 SOLD!



Cat K-3515.
See EA Jan/81

This 'Top of the line' Amplifier with a huge 50W per channel has just about everything you'll need in an amplifier! It's equivalent to units costing two and three times as much with features like:

- Full speaker switching between two sets of speakers (either, both or neither).
 - LED indication of input selection
 - Full tape monitoring facilities
 - Loudness and mute controls
 - State-of-the-art circuitry featuring power mosfets in the power amplifiers
 - Low distortion - typically less than 0.05% at normal listening levels.
- Comes complete with our exclusive step-by-step instruction manual.

High performance — up to the minute design — looks fantastic — and easy to build! What more could you ask for? The price?

A LOW, LOW

COMPLETE
WITH
PROFESSIONALLY
DESIGNED
FRONT PANEL

UPGRADE
YOUR HI-FI
NOW FOR
ONLY

\$165

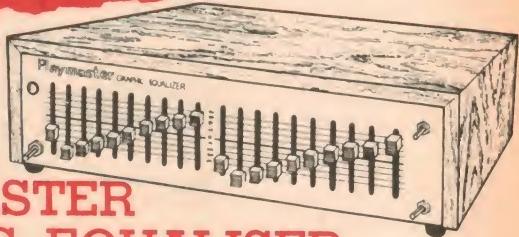
**ALL PLAYMASTER KITS
BASED ON EA PROJECTS**



BUILD IT
YOURSELF AND
**SAVE A
FORTUNE!**

DON'T
PAY \$350!

Build your own PLAYMASTER GRAPHIC EQUALISER



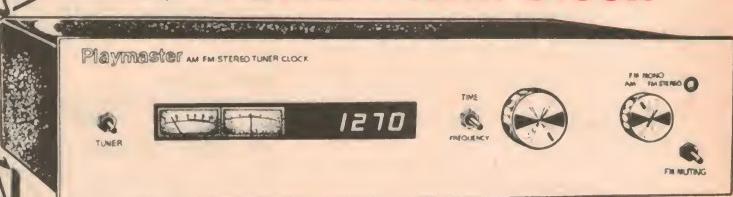
Correct all the problems associated with the acoustics of your listening room with this superb graphic equaliser kit from Dick Smith. 10 frequency bands in both stereo channels - you have total control over your sound! Or maybe you like to thrill to the high high's - or the low low's, out of the normal tone control range. With the Playmaster Graphic Equaliser you can get highs and lows you'd never have believed possible. Comes with 16 page step-by-step construction manual — fully illustrated so you shouldn't have any problems.

Cat K-3500
See EA MAY 79

AND IT'S ONLY **\$99⁵⁰**

THOUSANDS
SOLD!

ISN'T IT TIME FOR YOU
TO GET INTO FM?
**PLAYMASTER AM/FM
TUNER with Clock**



Professional quality pre-built tuner module means all the hard part of this kit is done for you. Dick solved the problem of FM alignment by importing a pre-built and pre-aligned tuner module ready to be built into a project. EA came up with a design incorporating digital frequency readout that doubles as a clock. Easy to build, comes with instruction manual. Superb tuner sound at this low low price will be hard to find anywhere else! Cat K-3494.

SEE EA NOV 78

SAVE \$20!
WAS \$159.10

ONLY **\$139**

Look at the advantages of buying Playmaster from Dick Smith.
Well written, exclusive instruction manuals.

We prepare a full instruction manual for all major kits, and an expanded manual for almost all kits. We give you all the information you need to complete the kit — info magazines don't have room to publish such as component illustrations, technical tips etc.

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In the unlikely event that you can't get your kit working, we offer you a low-cost repair service on most major kits. For the one fixed fee (details with each kit) we'll repair your kit, correct any mistakes and replace any damaged components. (We reserve the right to return, with service fee, any kits so badly wired that repair is considered impractical.)

Quality Control

To make sure your kit is correct we have installed \$20,000 worth of precision scales (accurate to one gram!). We weigh every kit we send out, and if it is out by the slightest amount we know something is wrong - so it is rejected. We find the mistakes before they affect you!

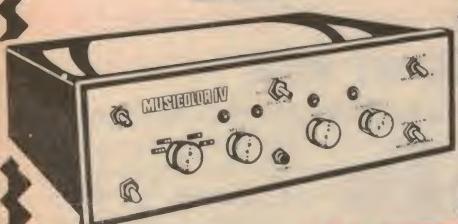
Keen Pricing

With over 14 years of experience in kit preparation, we know what you want. With our connections, we can get you the lowest possible price without affecting the quality of the components. You can trust Dick Smith Electronics.

7 Day Safety Guarantee

Buy the kit and examine it in your home for up to 7 days (14 days for mail order customers). If you're not completely happy with it, or confident you that you can build it, return it in original condition (i.e. before construction is commenced) and we'll give you a full refund.

TURN YOUR MUSIC INTO LIGHT!



ALL NEW MUSICOLOR Mk IV & LIGHT CHASER

Built-in microphone allows any sound to trigger Musicolor. Comes with sturdy chassis and exclusive Dick Smith front panel with LED display. Detailed step-by-step instructions are supplied.

Cat K-3143
SEE EA AUG '81 **ONLY \$91⁵⁰**

The Brilliant NEW

PLAYMASTER * SPEAKER SYSTEMS *

Dick Smith brings you these superbly styled speaker systems to suit your decor, your room ... and your pocket. Acoustically designed by Neville Williams, MIREE (Aust) Editor-In-Chief of EA magazine, they have a performance you'll be amazed at. You'll save a fortune over comparable commercial speakers — because you build them yourself! They only take a couple of hours construction time, and they look so good your friends will never believe you built them!

NEW FEATURES:

- ★ All new design in simulated wood-grain finish to complement decor
- ★ Separate level controls for high and mid ranges
- ★ Special speaker sealant material supplied to ensure complete air tightness
- ★ New design ribbed woofer with a massive 30cm cone for accurate bass reproduction
- ★ Built in plinth to raise speaker off floor level
- ★ Acoustically transparent silk-like grill cloth heat welded to support frame.
- * 300mm System only

EASY TO BUILD

The boxes simply fold together - no wood-working knowledge needed. After glueing and folding, hold corners together with masking tape to let the glue set.



All panels are pre-drilled, pre-cut and pre-rebated to make it even easier. The speakers just drop into position. We've even heard of schoolchildren building their own Playmasters



SUPERB FINISH

The new Playmasters feature a completely new format and style, starting with strikingly handsome new grilles with the new 'Playmaster' logo — and ending with a performance you'll be amazed at.



All you need is a tube of glue and a screwdriver — everything else is supplied. The wiring loom for the speakers is pre-assembled — the connectors just push on. If you can read simple instructions then you can build your own commercial quality speakers.



Place the grilles into position and push. They simply clip on. And now you're finished. Connect up your hi-fi, settle back with a drink and play your favourite record or tape. The sound quality will make you more than happy and your friends will never believe you built them!



\$100's cheaper than equivalent units!

300mm SYSTEM

Speaker kit, crossovers & faders
This kit includes 300mm woofers, high and mid range faders, and 3 way crossover with high power handling capacity.

\$175.00

Enclosure kits

A pair of large 70 litre cabinets for the ultimate in sound reproduction.

\$159.10

Cat C-2632

Deluxe speaker grilles

Handsome new design featuring the new Playmaster logo.

\$39.90

Note: All prices are per pair.

250mm SYSTEM

Speaker kit, and crossovers
This kit includes 250mm woofers and 3 way crossover with medium power handling capacity.

\$149.00

Enclosure kits

A pair of large 53 litre cabinets to give great sound reproduction.

\$143.10

Cat C-2634

Deluxe speaker grilles

Handsome new design to fit 53 litre cabinets, featuring the new Playmaster logo.

\$35.90

TOTAL SYSTEM ONLY TOTAL SYSTEM ONLY
\$374 per pair! \$328 per pair!

Here's what EA have to say:

"...the end result represents outstanding value for money. Whether you buy it in kit form or fully assembled, we are sure you will be pleased with sound quality."

"...the new Playmaster 3-70L has generous power handling capacity so that it can give a good account of itself on virtually any type of music"

Neville Williams & Leo Simpeon

(EA, March 1982)

DICK SMITH Electronics

See Page 98 for address details



DSE/A333/PAI



News Highlights

US moves to protect IBM computer secrets

Eighteen Japanese businessmen have been charged in the United States with conspiring to transport secret computer information stolen from IBM Corporation.

Six Japanese businessmen were arrested in California, and warrants issued for 12 others who live in Japan as a result of investigations by the FBI.

According to the US Justice Department the conspiracy involved separate efforts by employees of two major Japanese electronics companies, Hitachi and Mitsubishi, to obtain IBM information relating to the development of computers and computer peripherals such as printers.

Japanese giant Hitachi Ltd and 14 of its employees have been indicted by a Federal grand jury, the first step towards a trial of the case. So far Mitsubishi, although named in initial investigations, has not been charged.

None of the items that the Japanese allegedly tried to buy were actually stolen from IBM. Instead the materials, including design manuals and source code for new disk software, were temporarily "donated" to the FBI and used as bait for the Japanese, with the full approval of IBM.

The case against the Japanese is one outcome of an increasing emphasis on protecting United States technology from industrial espionage and unauthorised use abroad. The Reagan administration has repeatedly warned that the US will take a harder line in at-



tempting to prevent exports of "sensitive" American technology.

Director of the FBI, Mr William Webster, said that the case was a "classic example of the value of an undercover operation designed to ferret out the theft of high technology". He commended IBM for the "excellent assistance" it had given the bureau.

IBM said that it had become aware last year that documents containing important technical and product design information had been stolen, and reported the theft to the FBI. Some time later an IBM employee was approached by Japanese businessmen who said that they had incomplete computer manuals

and were willing to pay for the missing information.

IBM contacted the FBI, who set up a meeting between the Japanese and an FBI undercover agent. According to the Justice Department, employees of Hitachi Ltd paid \$US622,000 to the undercover agent for the "stolen" IBM documents, while representatives of Mitsubishi paid \$US26,000.

Those arrested for participation in the scheme include highly placed engineers and managers of Hitachi, and the assistant to the president of Mitsubishi Electronics America Inc.

Reaction in Japan to the arrests has been extensive. Japanese newspapers reported the case in "near crisis" terms. Fears are that the incident could lead to a worsening of trade friction with the US. The fact that the alleged attempt to steal confidential information was related to computers, already a source of deepening trade problems with the US, was treated very seriously by the Japanese.

A more general fear was that the arrests could lead to a rise in anti-Japanese feeling throughout the United States. The Japanese government has indicated that it believes the case is based on "entrapment", and seems to be in no hurry to answer extradition orders for the defendants currently in Japan.

SOLID-STATE LASER DEVELOPED BY RCA

Researchers at RCA Laboratories in the United States have announced the development of semiconductor diode lasers that can operate continuously at far higher power levels than existing helium-neon gas types.

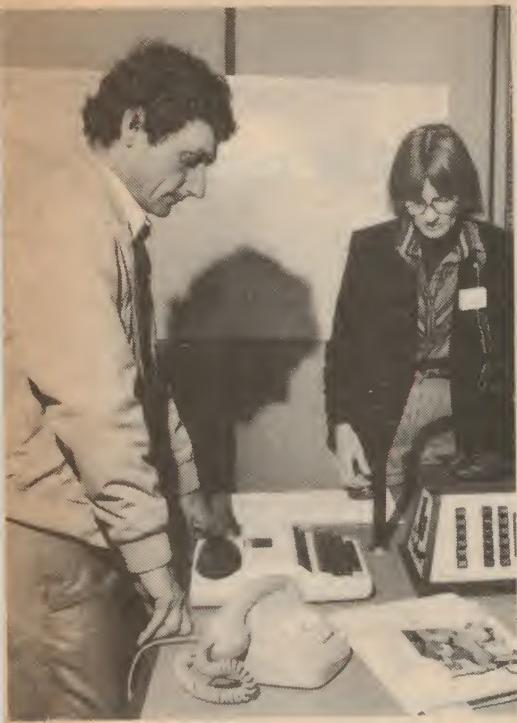
So far, helium-neon lasers with power outputs of between a fraction of a milliwatt to 50 milliwatts have proved to be the most practical for commercial applications. They are used in measuring and surveying equipment and in Philips' Laservision videodisc player.

Semiconductor laser diodes were demonstrated as early as 1962 (the laser effect itself was first demonstrated in 1960). Early versions quickly burnt out though, and could not produce a continuous beam. A semiconductor laser that could operate continuously without special cooling arrangements was not produced until 1975 and even then output was too low to be useful.

Late last year, however, researcher Dan Botez of RCA announced that the firm's laboratories had produced

a semiconductor laser that operated efficiently at a power level of 40mW. Six months ago Botez reported that the laser had operated for 10,000 hours in tests in which it was switched on for 50% of the time.

Semiconductor lasers offer advantages in size and robustness over helium-neon types. Successful development of a reliable semiconductor laser would be a boon to manufacturers of videodisc systems, reducing both the size and the complexity of the players.



New Telecom service — telephone typewriter for the handicapped

A telephone typewriter for deaf and speech-impaired persons became publicly available for the first time in Australia last June. Known as the Porta Printer Plus, the portable unit has been hooked up to red phones in 10 Telecom Business Offices in the Sydney metropolitan area for a six month trial.

To use the machine the telephone handset is placed in a special holder on the unit and the required telephone number dialled. Conversation is conducted by typing messages on the machine's keyboard. A visual display shows incoming messages. The unit is fully portable, operating on either mains or battery power.

Telecom will distribute the Porta Printer for private manufacturers, so buyers can order the unit through

Telecom for delivery by the supplier. Deaf and speech impaired people and their families can purchase the printer for \$846 — \$150 less than the normal price.

About 300 Porta Printers are already in private use around Australia and, in conjunction with the public trial, Telecom has released a directory of telephone typewriter users, listing more than 100 customers and including emergency numbers, schools for the deaf and deaf societies. Not all users could be contacted in time for inclusion in the listing but the directory will be reprinted as required.

For the duration of the trial a public telephone typewriter will also be located at the new Disabled People's Resources Centre, 323 Castlereagh St, Sydney, (02) 217 7376.

What happens if the computer fails?

Companies which depend entirely on their computers to carry on business may be riding for a fall, according to a new report carried out for large computer manufacturer Amdahl Inc.

Based on a study of two dozen large companies in Europe and the United States, the study found that most are "amazingly neglectful" of contingency plans to deal with computer failure. Sixty per cent of those examined had no written plans at all for dealing with disaster.

Nearly half of the total sample had no formal backup arrangements of any kind, although companies which had evaluated the risk to their business from a long interruption were "shocked" at the size of the problem.

Philips to re-enter VCR market

In a surprise move, Philips has announced that it is to re-enter the Australian video cassette recorder market.

Philips will not be marketing its own patented Video 2000 system here however, even though this format has proved successful in Europe. Instead, Philips has acquired the rights to JVC's VHS system and will manufacture video cassette recorders based on this format.

The decision in favour of VHS reflects recent figures which indicate that VHS format VCRs and tapes have about 60% of the Australian market.

Stand aside Dick Tracey — it's (almost) a wristwatch TV receiver

By the end of the year, gimmick-conscious Japanese will be able to purchase a "wristwatch television", a little like the one made famous by the Dick Tracy cartoon series.

Priced at around \$A400, the wristwatch TV is made by Suwa Seikosha Company, one of the firms of the Seiko group. It will provide a 30mm x 22mm liquid crystal display screen in a watch case that also includes time, calendar, alarm and stopwatch features.

The television circuits and a stereo FM radio receiver with two alkaline cells for up to five hours of viewing will be in a small pocket unit, with earphones whose cord also functions as the antenna.

A single large-scale integrated circuit provides the display screen, with a switching transistor for each picture element



Wristwatch display — the TV circuit is housed in a small pocket unit.

and shift registers for scanning the display. Resolution is 152 dots horizontally by 210 vertically, giving a total of 31,920 picture elements. Power consumption of the display is 100mW, while total power consumption for the VHF/UHF television circuitry is 500mW.

Financial Review now on Ausinet

Media group John Fairfax Ltd, which among other things is the parent company of Electronics Australia, has recently introduced an electronic index for The Australian Financial Review.

The service will be carried on the Ausinet public database system operated by ACI Computer Services, one of Australia's largest computer service bureaus. It will allow Ausinet users to access a file indexing virtually every local article contained in the Financial Review.

Headlines and first paragraphs of each local article of the paper, together with keywords and company references, will be available from the database, while a printed copy of the entire article will be available on request.

Mr Ian McCallum, information retrieval systems manager for ACI Computer Services, said that the new financial database was one of a number of new services which will be offered as Ausinet moves increasingly into the commercial area.

Robots: no threat to employment says US report

"Tremendous" momentum in the industrial robot market could propel it to the \$US5 billion level over the next 10 years according to a recent report from International Resource Development Inc, a United States market research and consulting firm. The report analyses the expected impact of entry into the market by IBM, General Electric, Westinghouse and Bendix, and predicts that these firms will be joined by Texas Instruments and several other computer manufacturers.

According to Kenneth Bosomworth of IRD "there are some big opportunities just now becoming evident for small robots — those with less than 5kg

capability — in a large variety of light manufacturing industries". Bosomworth believes that the established vendors of robots failed to spot these opportunities "because of their preoccupation with big dirty robot jobs in foundries and automobile factories".

The IRD report is optimistic about the impact of robots on employment. "There will certainly be many thousands of situations in which robots replace blue-collar workers" according to Bosomworth, "but robots on balance will probably help reduce unemployment". Large numbers of people building, marketing and servicing robots will directly create jobs, while more effi-

cient manufacturing processes will stimulate general economic activity.

This, of course, assumes that direct employment gains from robot manufacturing will occur at the same rate (and in the same country) as job replacement, and ignores the current Japanese practice of using robots to build robots.

In Europe, where industrial workers have resisted factory automation, the IRD report expects the extension of programs such as West Germany's national job retraining program. Other programs are also now operating in Europe to help retrain workers displaced by automation.

BBC computer — Australia next?

The BBC's new Computer Literacy Project got under way earlier this year, aiming to teach people what computers can do and, for those who want to go further, how to operate one.

A series of ten 25 minute television programs designed for newcomers to computing is the basis of the project, together with a specially developed microcomputer with accessories such as cassettes, disks and teletex link-up. A book and a correspondence course is also available.

Initially the idea was simply to have a television series supported by a book. In order to answer the demand for practical experience however, it was decided to link the course to a particular microcomputer. The BBC chose Acorn Computers to design a basic model which could be used with the course.

For a basic price equivalent to \$A508, the Acorn/BBC computer features a full keyboard, high definition colour graphics and sound effects. The BBC is also providing special software on cassettes or disks, and those whose television set is fitted with a teletext decoder can also receive broadcast computer programs directly.

As yet the project is confined to Britain, chiefly because it has been so successful that demand for the Acorn microcomputers is far outstripping supply. Plans are being made for extending it to other countries, and Australia is high on the list of prospects. New Zealand, Canada and the United States are also reported to be interested in acquiring the series.

Defence force communications network

Tenders for the Australian defence forces communications network (DISCON) will be called shortly, according to the Australian Electronics Industry Association. It is understood that six companies are in the bidding phase for DISCON, after having spent up to \$400,000 each on their respective tenders.

Although the tendering cost is high, the lure of the contract is felt to be worthwhile. The original value of the DISCON contract was estimated to be about \$200 million — the largest defence communications contract ever let in Australia. That figure was to cover an Australia-wide secure digital com-

munications link.

The forthcoming tender has been trimmed to cover the Eastern states only. A later phase of the project will cover nation-wide expansion.

Strictly designed for defence purposes, DISCON will handle all forms of communication — voice, data, facsimile and telegraph. The major requirements are reliability and data security, and messages transmitted on the system will be passed through encryption devices to "scramble" them to defeat eavesdroppers.

No other similar centralised defence communications system is in use anywhere in the world.

Getting to the core of a nuclear reactor

British scientists have found away of looking right into the heart of a fast nuclear reactor. Previously, it had been impossible to examine such a reactor visually because the core is submerged in a tank of sodium liquid metal which acts as its coolant.

In the first successful experiment of its kind, pictures have been received from inside Britain's prototype fast reactor at Dounreay in Scotland. During the experiment, scientists saw the reactor core in fine detail more than five metres beneath the surface of the sodium pool.

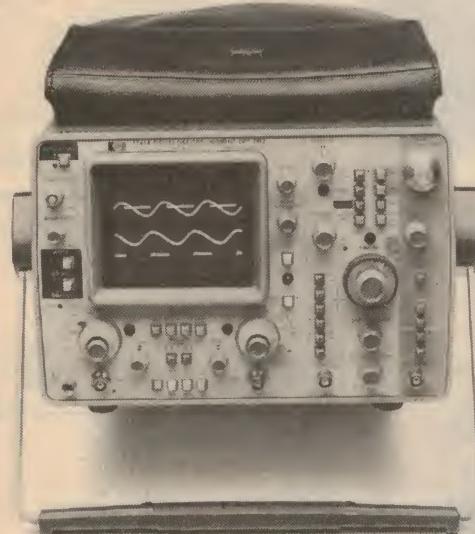
Using a new high-frequency sound technique developed at the UK Atomic Energy Authority's Risley laboratories in Cheshire, the experts obtained clear, col-

our television images of the whole of the outer core. The process offers the prospect of relatively simple checks on changes in the structure of materials in the reactor caused by fast moving neutrons.

To take the pictures, a 10-metre long tube was fitted with ultrasonic pulse-echo equipment and lowered close to the core during a routine shut-down of the reactor. High frequency pulses were then transmitted through the molten sodium.

From the echoes received from the top of the core a computer is able to produce a clear image on a colour television screen. Variations in the colours represent changes affecting the reactor core.

Three ways of measuring a fast pulse without visiting your doctor.



High Frequency Scopes.

At Hewlett-Packard we've always had our fingers on the pulse of innovative technology. Our HP 1700 range of oscilloscopes are no exception. Bandwidths of 100, 200 or 275 MHz offered by our models 1740/1742/1743/1715/1725/1722, coupled with excellent trace quality means reproduction of pulses or wavetrains with fidelity. The Dual delayed timebase (or delta time) feature found on some models incorporates two intensified trace markers and allows more accurate measurement of pulse characteristics such as risetimes, period and phasing.

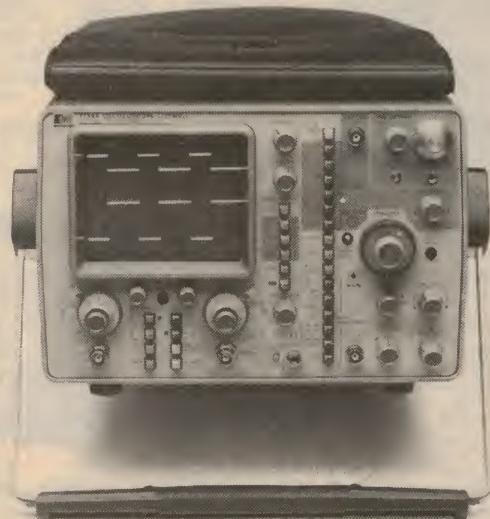
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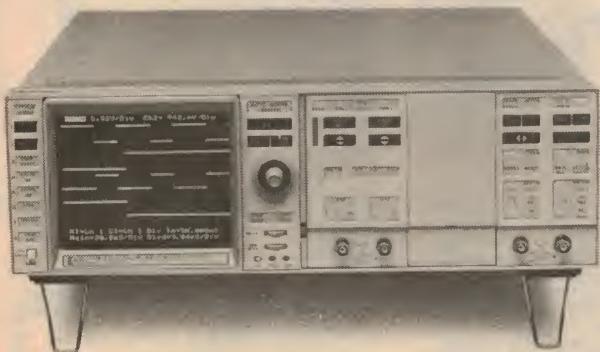


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New "Super lamps" may cut energy use

A fresh look at the light bulb

Low cost but inefficient incandescent light bulbs are becoming less and less practical as energy costs continue to climb. New research developments such as fuzzy filaments and high power phosphors may be the beginning of revolutionary progress in lighting technology.

A violet glow from the plasma in a vacuum chamber illuminated a small room at Bell Labs, Holmdel, New Jersey. Moments before, researcher Richard Howard had switched on a pump, evacuating the glass container. Argon, oxygen, and Freon were fed into the vacuum jar. Now these ionised gases hovered a few centimetres above the chamber base, like a neon-lighted fog over a city.

Put a prepared sample of tungsten beneath that plasma, wait one minute, and the metal turns pitch black, I discovered. The plasma etches an invisibly fine, "fuzzy" texture into the tungsten's surface. That gives the metal a remarkable property — heat it to incandescence and it will radiate twice as much visible light as ordinary smooth tungsten.

Not that Bell Labs is gearing up its parent, AT&T, for the light-bulb business. What happened was that a few years ago Bell began studies to develop materials that would selectively absorb wavelengths of solar radiation. Along the way, a new etching process was discovered that may one day provide more-efficient home lighting.

This is just one example of the kind of research that may one day radically alter the guise of that most familiar of great inventions — the light bulb. The need is pressing. As energy costs continue to climb, low-cost but poor-efficiency incandescent lamps become less and less practical for the home. So the search is on for new techniques and materials that will yield greater light output while using less energy.

Most basic lighting research is, naturally enough, conducted in the labs of

General Electric, Sylvania, Westinghouse, Philips, and other lighting firms. Each has announced economic alternatives to the incandescent lamp. But I wasn't surprised when these companies declined to talk about their advanced projects. The lamp business is very competitive. Industry experts discuss only basic research and areas where studies might pay off in general terms. Some examples:

- Developing phosphors that can absorb and use infrared as well as ultraviolet radiation, plus more-efficient

phosphors for fluorescent lamps.

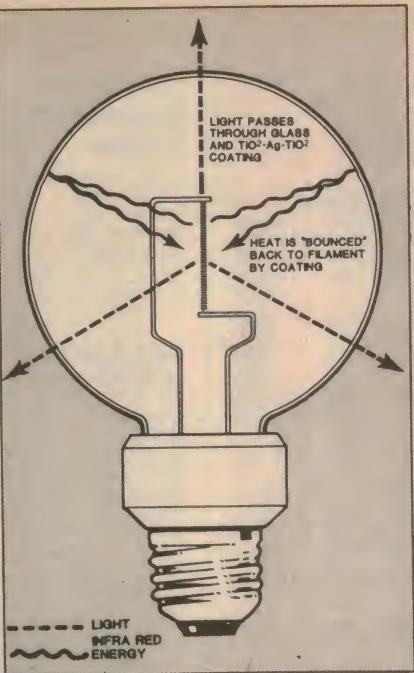
- Discovering molecules beyond the limited number already used that either radiate visible light or fluoresce under ultraviolet.
- Perfecting solids and even liquids that radiate light efficiently.

Locking in the infrared

The modern incandescent lamp has climbed steadily in efficiency compared with the carbonised thread — delivering 1.5 lumens per watt — used by Thomas Edison in 1879. The slightly more-



Glowing plasma etches tungsten, which can then radiate light more efficiently.



Duro-Test lamp uses a heat reflective coating inside the spherical light bulb.

efficient GEM filament was graphite-coated cellulose. Early refractory metals such as osmium and tantalum gave better efficiency. The Nernst lamp used a glowing rod made with oxides. Lighting engineers have continued to make progress until the present day (see Fig. 1).

Still the modern tungsten-filament lamp provides only about 17 lumens per watt. About 80% of its energy is wasted as invisible infrared radiation. Why not capture this wasted energy and put it to work heating the filament and lowering your electric bill? Researchers have been

trying to accomplish this for some 50 years, and one firm, Duro-Test Corp says it has found a practical method.

The "Duro-Test Mi-T-Watt Saver" bulb, being readied for manufacture, uses a three-layer coating on its inner surface. This thin-film coat was originally developed at the Massachusetts Institute of Technology for solar-energy applications — an example of fortuitous research analogous to Bell Labs'. The middle, silver, layer reflects infrared radiation, and the bulb's spherical shape focuses this energy on the filament.

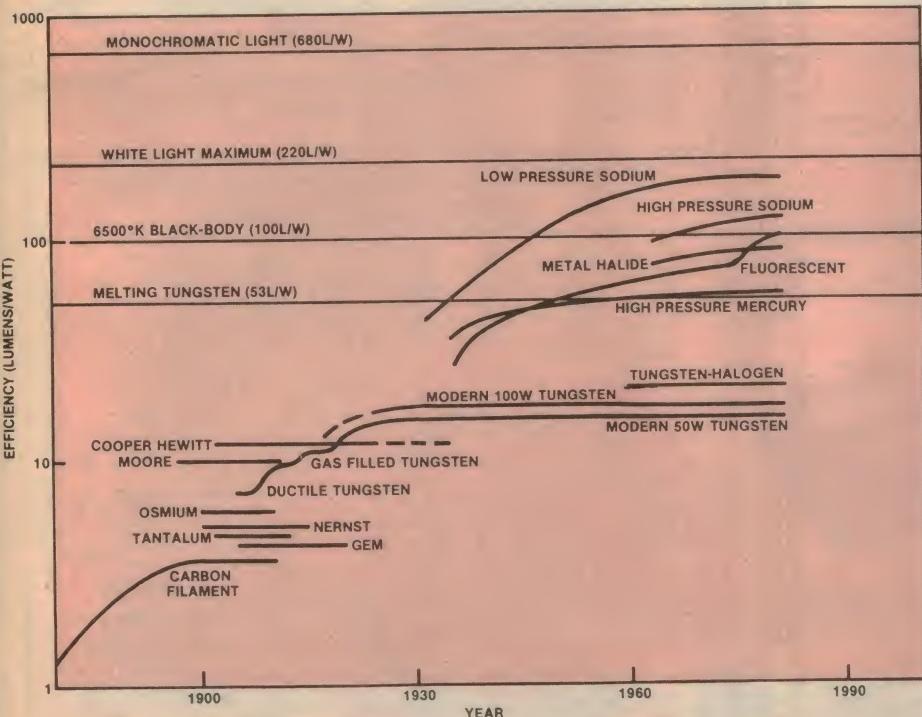


Fig 1: Improvements in lighting efficiency over time, shown with standard sources.

Titanium dioxide has a high index of refraction. Thin layers of this material on either side of the silver serve as an anti-reflection coating. It helps visible radiation from the filament to penetrate the glass envelope.

Duro-Test says that energy savings of up to 60% are possible when reflective-coating bulbs are compared with conventional bulbs, and experiments yielded a net energy saving of 51%. Whether similar savings become feasible with mass-produced bulbs remains to be seen.

A key step, applying the coatings, might be accomplished by sputtering atoms from a cathode with RF (radio frequency) energy, by chemical vapour deposition, or by thermal evaporation. The bulbs will also have to be mass-produced with each filament at the focus of the film for full efficiency.

While Duro-Test refines its bulb that keeps heat in, several researchers at Bell Labs believe they've found a better way of getting visible light out of incandescent lamps. The etching process described earlier makes the smooth surface of tungsten, under an electron microscope, look like a carpet. Tungsten "tufts", though, are so small that five of them can stand side by side along a one-micron (millionth of a metre) line.

These cone-shaped metal columns produce a gradual physical transition from the tungsten to a vacuum in which the metal is resistively heated. As a result, visible light over the 0.3-0.7-micron range is emitted twice as effectively as from ordinary tungsten. Bell Labs' Harold Craighead compares the light radiation to sound waves from a horn. Gradual flaring at the output of an instrument permits air to flow smoothly into the air.

While the textured surface enables visible light to escape more easily, longer wavelengths do not. Tungsten, therefore, won't radiate and waste more heat. But there are obvious problems, too: "It's entirely clear that this surface is more delicate than solid tungsten," says Craighead.

Could the ultra-fine structure last long enough for a practical lamp filament? "It's open to someone doing R&D work on it," Howard said. "We're just not in the light-bulb business." He says the textured surface enables tungsten to be used at lower temperatures yet put out more light than smooth or uniformly black surfaces.

The etching technique, incidentally, will also be applied to creating the sub-micron structures needed for very high density microcircuits, or perhaps to "fuzz" a metal coating on a plastic disc for an optical digital recorder, or to create high-surface-area catalysts. Bell has other uses in mind, too, but isn't talking about them now.

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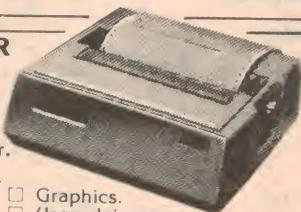


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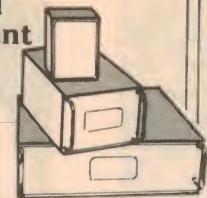
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A fresh look at the light bulb

Fluorescent lamps, with 80-lumen-per-watt efficiency, offer economic advantages over incandescents. About 66% of electrically produced lighting throughout the world is from fluorescents.

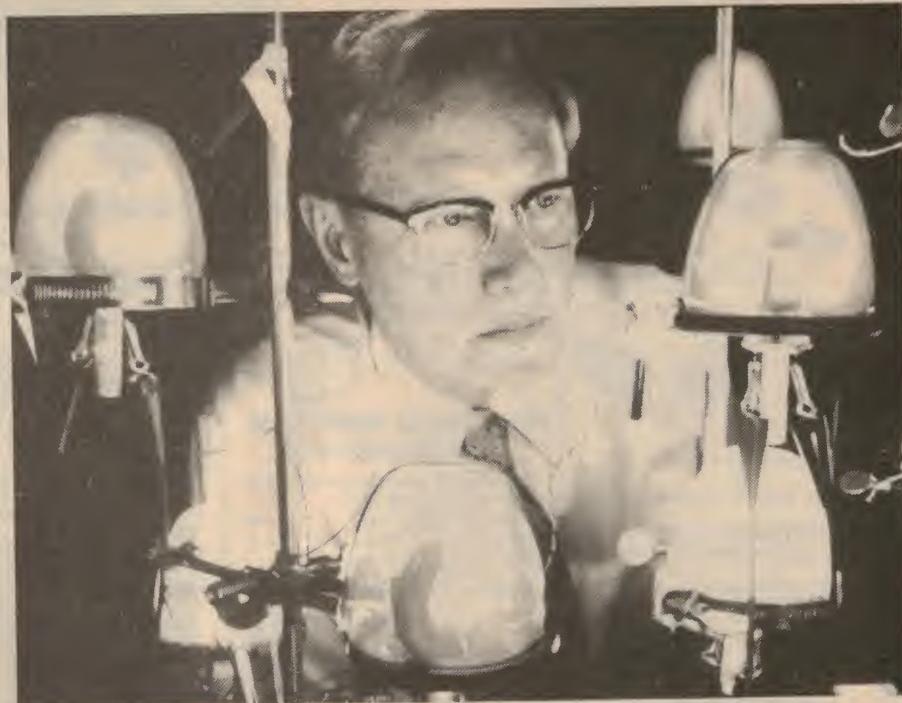
"Since its introduction, the primary performance improvements in the fluorescent lamp have been in phosphors and the durability of the electrodes," said John Waymouth of Sylvania. Lamp performance is limited by characteristics of materials used in fluorescents. "Further improvements in performance will depend on further improvements in those characteristics, especially phosphors," he adds.

Look — no electrodes

Shrinking long fluorescent tubes into compact sizes suitable for the home can reduce lamp efficiency. One reason is that losses occur at both ends of any tube, near the electrodes. Bringing the electrodes closer together and reducing the surface area of phosphor cuts efficiency.

GE's experts showed me an ultra-compact fluorescent that avoids this end-loss problem by eliminating electrodes. The lamp, about the size of an incandescent 100-watt bulb, has an electronic ballast just above its screw-in base. A quarter-size ferrite core in GE's SEF (solenoidal electric field) lamp is the primary of a transformer, while the mercury/noble gas itself acts as the secondary.

"We had to develop phosphors that could withstand high power density," GE's John Anderson told me. The SEF bulb, which is still too inherently costly for mass production, delivers 50 lumens per watt. A 40-watt SEF bulb, therefore, puts out 2000 lumens. By comparison, a



General Electric physicist John Anderson inspects experimental lamps that promise savings through lower operating costs and longer life.

100-watt incandescent provides 1750 lumens.

Scientists are still exploring the enormous range of substances that can be used in lamps. The great variety of additives used in tungsten-halogen lamps, for example, produced similar results, but researchers still aren't sure how complex chemical reactions work in these lamps. Skill gained in selecting different additives will enhance the colour output and lifetime of both tungsten-halogen lamps and the more efficient metal-halide arc lamps.

So, what's coming along to replace in-

efficient incandescents in the home? "Based on past experience, we might soon expect the beginning of a decade or so of revolutionary progress in light-source technology," said John Waymouth of Sylvania. "In all likelihood, the first system to overcome its technical problems and break the critical cost barrier will capture a large fraction of this very large market," he adds.

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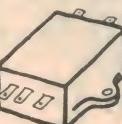
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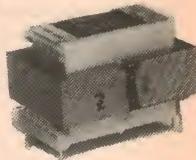
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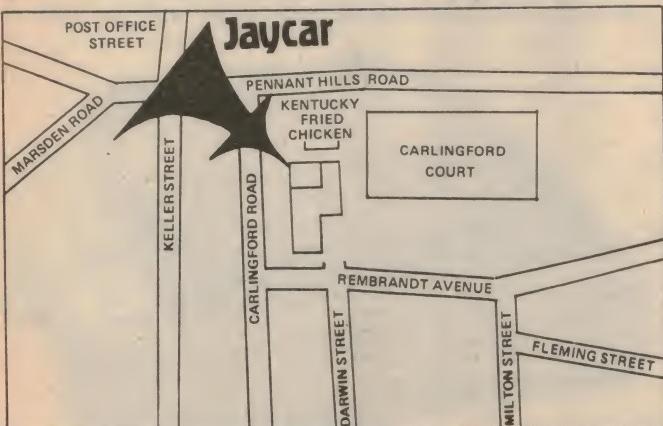
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Choosing a printer: a buyer's guide

Choosing a printer for your personal computer is not the simplest of tasks. The information presented here can make it easier for you to make your decision.

by SCOTT PARKER

ONCE THE PROUD OWNER OF A PERSONAL COMPUTER has learned how to operate his machine, write programs, and beat the computer at some of its games, he tends to turn serious. He'll prepare his taxes, perhaps file his wife's favourite recipes, and use his computer to keep track of his stamp, coin, or record collection. If he owns a business, he may file his inventory, prepare payrolls, and list bills on the computer. At this point he can no longer rely on his CRT display alone for there comes a time when the data from the computer cannot be analysed sufficiently while the user stares at his display. He needs hard copy, on paper, to put in his briefcase, to carry to meetings and discussions, and to distribute to others involved in decision-making.

So it's off to the computer store to select a printer. And that's where the fun (or frustration) begins. A multitude of different models are available from close to 100 printer manufacturers. Salesmen will confront the puzzled buyer with a flurry of terms such as "dot-matrix", "KSR or RO", "daisy wheel", "pin feed", "characters per second", and the like. So, rather than face that bewildering barrage of terms unprepared, it is appropriate for the prospective buyer of a printer costing from hundreds to thousands of dollars to learn a bit about them before taking the plunge.

To start, let's differentiate between a *print head*, a *printing mechanism*, and a *printer*. A *print head* is the component that creates the character on the paper. It can be a dot-matrix impact-type, thermal non-impact-type, or one of a number of other designs. Without the mechanical elements to move that print head to the proper position, without the electronics to control positioning and carriage return, the print head is entirely useless.

The *printing mechanism* is a mechanical assembly, including a print head, with the necessary gears and drive to perform the movements required for printing; it may or may not include a cabinet or electronics section. The *printer* is the complete assembly, including print head, printing mechanism, cabinet, and the necessary electronics.

KSR and RO

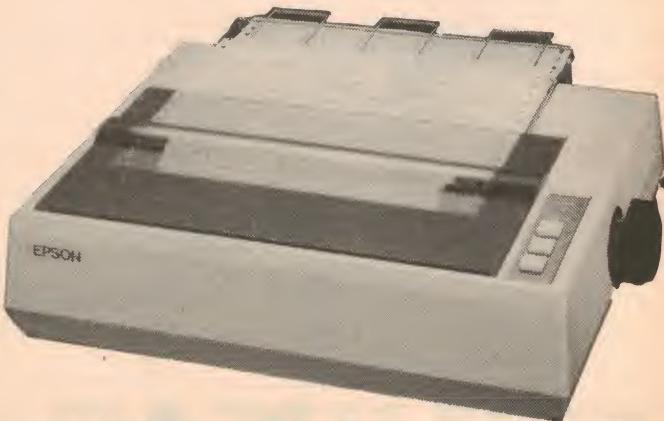
Printers can be classified in a number of ways. First, whether they include a keyboard to enable them to send, as well as

receive, data. A printer/terminal includes a keyboard that permits the user to input or output data by direct connection to the computer, or via a telephone line and modem. Those two-way units are called KSR (Keyboard Send/Receive) printers. Many manufacturers supplying KSR's also market similar assemblies — less the keyboard and output-electronics section — that serve as one-way or Receive-Only (RO) printers.

Impact vs non-impact

Impact printers generate a character by having the print head strike the paper through an inked ribbon; portable and office typewriters are common examples of impact printers. Non-impact printers generate characters without mechanical force; the small thermal printers in some low-cost printing calculators are examples of non-impact printers.

Impact printers have two major advantages over their non-impact rivals: they produce high-quality print, and can provide multiple copies. Their major drawbacks are a high noise-level and low speed. Non-impact printers are quiet and many are low in cost. They generally operate at much higher speeds than impact types. Their drawbacks include the inability to produce more than one copy at a time and the need for



Epson MX-80 dot matrix printer offers many features. (Photo courtesy of Micro-80, PO Box 213 Goodwood, SA.)

relatively expensive paper. Also, their outputs is frequently less legible than that of impact types.

Impact printers that use solid type-fonts (as opposed to dot-matrix fonts) have their character sets on cylinders, balls (like the IBM Selectric print-elements), drums, bands, or wheels. As the computer informs the printer of the character required, that character is moved into position and struck so that an inked ribbon makes an impression on the paper. The next character is then moved into place and the process is repeated.

Non-impact printers include thermal, electrosensitive, ink-jet, and laser types. While the latter two are still far too expensive for the personal-computer user, thermal and electrostatic printers are generally available for less than \$1000 and that, coupled with their quietness, makes them well suited to home or small-business applications.

Low-cost printers (under \$400) in those categories may use narrow rolls of paper, similar to those used by printing calculators that are limited to 32 characters (or columns) per line. Printers costing over \$500 generally accept 8½ inch wide paper and can print 80 or more characters per line.

Generally speaking, printers selling for under \$1000 are of the dot-matrix type (with the exception of used Teletype machines). Dot-matrix printers with special features — like very high speed, or special head or paper-movement capabilities — may be more expensive.

In the \$2000-and-up range are the "solid-character" printers using "golf balls", daisy wheels, or thimbles. They offer very high print quality, suitable for business letters and lengthy reports.

Serial printers vs line printers

Printers can also be classified as *serial* or *line*. *Serial* printers — which are what we are discussing here — print one character at a time. *Line* printers print an entire line at a time and are generally used where very high volume and speed are required, as in the case of printing thousands — or even millions — or mailing labels or paychecks.

Serial printers have a single print head that moves horizontally across the page, printing one character at a time. If the printer is fast enough, it can print each character as it is received from the computer; otherwise the data must be stored in a *buffer* and fed to the print mechanism more slowly.

Line printers contain many print heads and hammers, or print actuators — one for each column. When an entire line's worth of characters has been stored in the line printer's buffer, the print mechanism is actuated and the entire line printed at once.

Speeds of *serial* printers are usually given in characters-per-second (cps); speeds of *line* printers are specified in lines-per-minute (lpm). A low-speed *line* printer may be rated at 300 lpm, a medium-speed one at 300-600 lpm and a high-speed one at over 600 lpm.

Typically, dot-matrix *serial* printers operate at speeds in the range of 60-400 cps. "Solid-character" *serial* printers operate at the rate of 25-60 cps.

Naturally, the high-speed *line* printers are considerably more expensive than the slower *serial* printers. The most popular types of *line* printers are *drum*, *chain*, and *scanning matrix*.

Fully-formed (solid) or dot-matrix characters

Depending on the type of printer used, the characters formed may be either *fully-formed* (solid, typewriter-quality) or *dot-matrix*.

Dot-matrix characters are formed by a series of dots arranged in a matrix measuring from four to seven dots horizontally by seven to nine dots vertically (see Fig. 1a). Thus, a 7 × 7

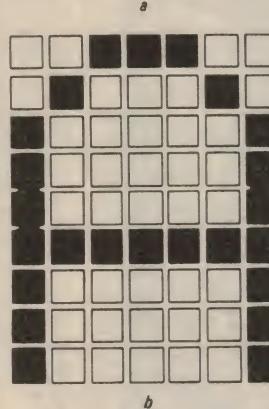
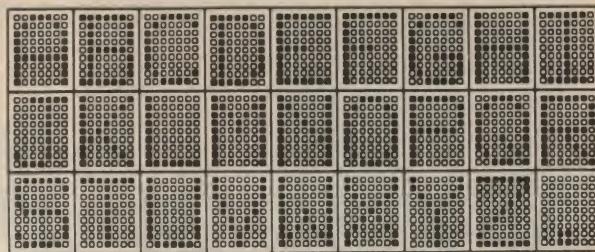


Fig. 1 Dot matrix characters are formed by dots in a grid, as at top. In 1b, dots in a 7 × 9 matrix form letter "A".

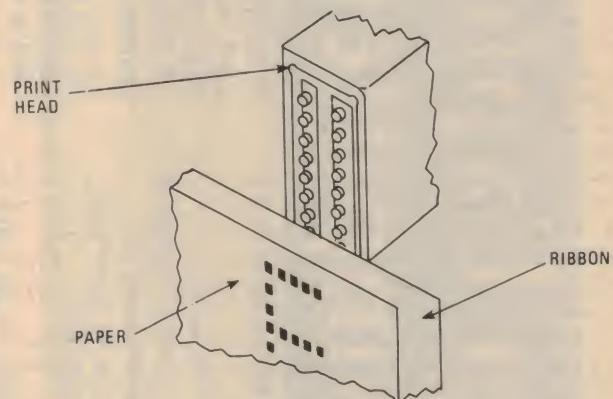


Fig. 2 Pins actuated by solenoids produce the dots that form characters in an impact type dot matrix printer.

matrix could have up to seven dots in both directions. Characters are determined by the number and positions of the dots within the matrix, as shown in Fig. 1b. Since the characters are not formed from continuous lines, legibility is not as good as that obtained from printers using fully-formed characters. The more dots used in the matrix, however, the better the appearance will be.

Impact-type dot-matrix printers produce characters using a moveable print-head mechanism that consists of solenoid-actuated pins arranged as shown in Fig. 2. As data arrives from the computer, a character-generator ROM in the printer selects the appropriate dot-pattern for the character to be printed and energizes the solenoids required. The solenoids cause print needles to strike the ribbon and form the dot-pattern on the paper.

Some dot-matrix printers, instead of using a ribbon, make use of a special paper that contains "micro-bubbles" of encapsulated ink. When the bubbles are struck by the print needles they burst and release the ink.

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dot-matrix printers involves multiple passes of the print head across the same line, with the head position slightly offset for each pass. That allows more dots to be printed and creates denser, more legible, characters. The drawback, of course, is a reduction in print speed.

A recent innovation in the dot-matrix field is the "throw-away" print head. When it wears out — as will eventually happen in any case — no expensive service is needed. You can just unplug the worn-out head yourself and replace it with a new one that costs about \$30.

Cylinders, balls, and wheels

The earliest version of a full-character printer was the cylinder or Teletype, which had its type on a cylinder that rotated along a vertical axis on a moveable carriage (see Fig. 3). As the computer requests a particular character to be printed, the carriage moves to the correct location on the paper and the cylinder is rotated, and also raised or lowered, to place the proper character into position so that a hammer can strike and force the character against the ribbon, printing the letter on the paper. The Teletype models 33, 35 and 38 are considered noisy, slow (10 cps), unreliable and difficult to service — but they do fulfill the need for a low-cost printer.

The "golf-ball" print head (see Fig. 4) developed by IBM for its Selectric typewriters, contains a full set of characters embossed on a sphere. Printing is performed as the ball strikes an inked ribbon placed between the ball and the paper. When a change in font or typeface is required, ball replacement is simple and the cost for the print elements is low. Speed is relatively slow, about 15 cps, and the mechanism is quite noisy. However, print quality is good, and used, reconditioned models are available at low cost.

The daisy wheel, introduced by Diablo Systems, Inc in 1972, is three to five times faster than the "golf-ball" or cylinder types, with speeds up to 80 cps. Its name is derived from a resemblance to a flower with its petals outstretched (see Fig. 5). The mechanism consists of a central hub which has up to 96 arms, each containing an embossed character. When the required petal or character is rotated into the proper position, a hammer strikes the petal against an inked ribbon to produce the letter-image on the paper. The daisy wheel elements, available in steel or plastic, come in a variety of typefaces and can be interchanged simply and rapidly. Print quality is very good but noise level is somewhat high.

Thermal, electrosensitive and ink-jet printers

The thermal matrix-printer is a popular form of a non-impact system. As the print head moves horizontally across the specially manufactured paper, characters are formed as the heating elements in the print head discolour the paper into a dot-matrix pattern. Thermal printers are light, compact and quiet, and the print head is inexpensive and easy to replace. However, the heat-sensitive paper is expensive and only one copy at a time can be produced.

The electrosensitive matrix printer requires a special aluminium-coated paper which forms a dot-matrix pattern when voltage is applied between the print head and a metal plate, burning off the aluminium to expose a black layer below. The paper travels between the print head and the metal plate (see Fig. 6). As data is fed to the print head, electrodes in the print-head housing are pulsed selectively, causing a charge to jump between the electrode and metal plate (rear electrode), creating black dots on the paper and thus the character. Although the electrosensitive printer is inexpensive and its quality is good, paper is expensive and requires delicate handling. A newcomer to this printer family is the laser printer which uses a low-power laser to burn dots off a specially-treated paper.

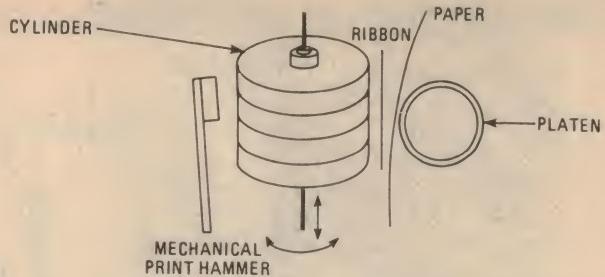


Fig. 3 Cylinder printers use a rotating cylinder on a moveable carriage. When positioned a hammer strikes cylinder.

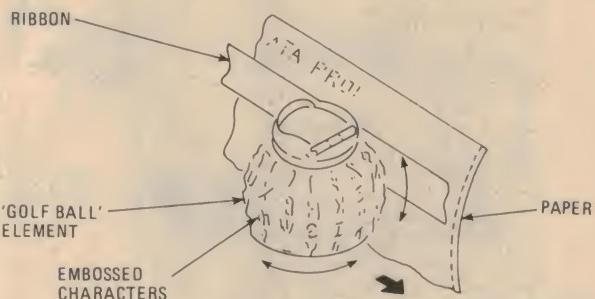


Fig. 4 IBM Selectric print head is a "golf-ball" sized sphere embossed with a full set of characters.

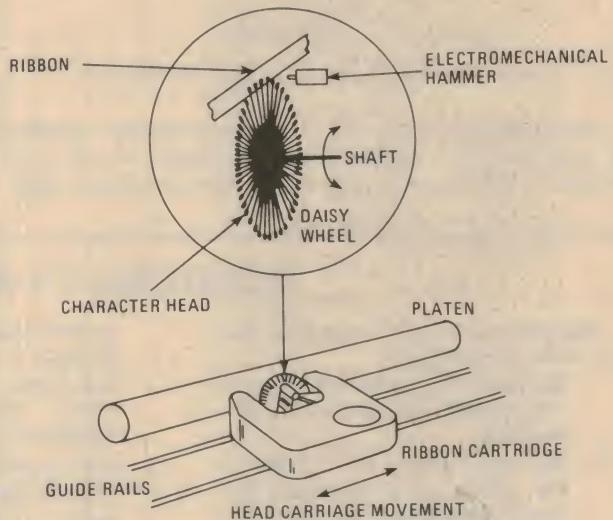
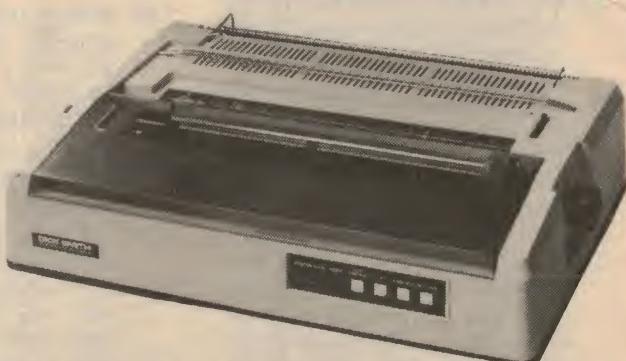


Fig. 5 Daisywheel printer is much faster than a Selectric. The print wheel gets its name from resemblance to the flower.



C-Itoh FP-10 daisywheel printer is fast (40cps) and economical. (Photo courtesy of Dick Smith Electronics Pty Ltd).

Choosing a printer

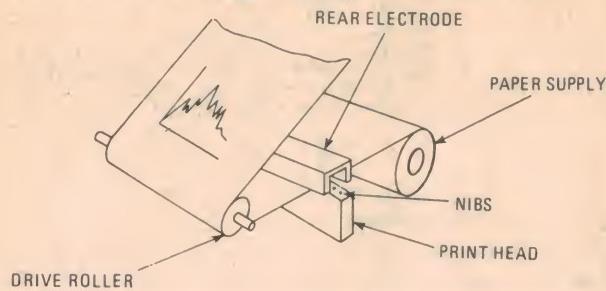


Fig. 6 Electrosensitive printer "burns" characters on paper.

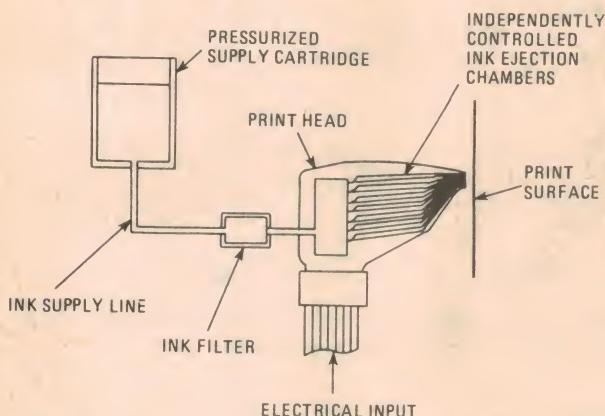


Fig. 7 "Drop-on-demand" ink jet printer mechanism.

Ink-jet printing is a non-contact process. Neither cylinders nor "golf balls" nor ribbons touch the paper. In an ink-jet mechanism, ink is pumped through a tiny nozzle, forming a

steady stream of fluid; the nozzle is vibrated to modify the stream into a series of droplets rather than a steady flow. As an individual droplet leaves the nozzle and is directed towards the paper, its position is controlled so that its final placement, relative to other released droplets, will form the desired characters.

Several droplet-placement techniques are in use, including electrostatic deflection, controlled nozzle movement, and controlled paper movement. Another technique involves the use of a number of independent nozzles tightly packed into a print head with selective firing of individual nozzles determining character creation. In the "drop-on-demand" technique, shown in Fig. 7, an electrical signal, is converted into a pressure pulse in the ink chamber. That causes droplets of ink to be discharged from the independently controlled ejection chambers and form printed characters.

Serial vs parallel transmission

Computers transmit data to a printer in either serial or parallel format. In serial transmission, single bits of a byte follow each other in a steady stream; in parallel transmission, all the bits required to define a character are routed along parallel wires at the same time. Therefore, serial transmission is slower than parallel transmission. However, only one communications channel is required for serial transmission which means that serial data can be transmitted over a telephone line; in addition, serial data can be transmitted over a longer distance than parallel data without the need for special amplifying repeaters.

Serial data-transmission can be synchronous or asynchronous. In synchronous transmission, it is necessary for the system to be aware of the exact time-position of each data byte representing a character to be fed to the printer. The flow of characters is split into blocks, with all bits in each block transmitted at equal time intervals. Even if no data is fed during a brief time period, data bits, called "nulls" must be used to fill in the blocks. Stable oscillators act as clocks at both ends of

QUESTIONS TO ASK BEFORE BUYING

Here are some of the points you will have to consider:

1. Will noise be a problem? If so, a non-impact printer is recommended.
2. Will print quality be critical? If the printer is to be used for word processing or for correspondence, a full-formed-character printer is the best choice.
3. Will multiple copies (for billing, records, etc) be required? If so, a non-impact printer is ruled out.
4. Will frequent changes of typeface be required? If so, a printer with interchangeable elements ("golf balls" or print wheels), or a programmable matrix-printer, will be needed.
5. Will a lot of printing be done? If so, paper costs could become prohibitive if a thermal or electrosensitive printer were used. (Also make sure that ribbon changes on impact printers are simple to accomplish.)
6. How fast does the printer have

to be? Speed is directly related to cost — the faster the printer, the more expensive it will be. There also tends to be a tradeoff between speed and print quality — the higher the speed, the lower the quality.

7. What form of paper transport is required? For continuous-form paper, or for multiple copies, pin or tractor feed is the choice.
8. Will the printer be running unattended? If so, it should have alarms and/or shut-off devices to handle "out-of-paper" and other situations.
9. What is the maximum number of columns (characters per line) that will be required?
10. Will both upper and lower case characters be required? Will any special characters or symbols be needed? Make sure they are available.
11. Will a one-way, receive-only (RO) device be sufficient or will a two way (KSR) unit be required? The obvious choice is a

RO printer, but give some thought to future needs.

12. How reliable is the printer manufacturer? How long has he been in business? What have you heard or read about his equipment? A "steal" on a printer whose manufacturer has gone out of business could mean problems should the device require parts or servicing.

Don't be afraid to ask questions — of yourself, of dealers, and of printer owners at local computer clubs. Remember, you'll be spending hundreds — if not thousands — of dollars on a piece of equipment that you'll be depending on for years.

Take your time; call or write to manufacturers for specifications or definitions of terms on their data sheets. And, once you've made up your mind, visit your dealer and ask him to let you get some first-hand experience with the printer you've chosen to make sure it really is right for you.

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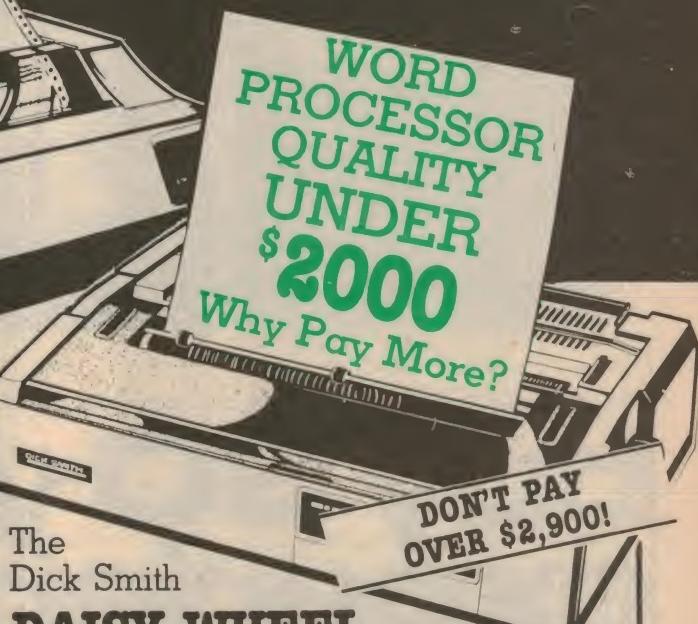
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Choosing a printer

the transmission to maintain synchronisation and precise timing. The computer, acting as the transmitter, starts each block with a series of synchronisation signals to denote the start of a block and thus synchronise the oscillators; the block is generally ended with an error-checking character.

Asynchronous transmission is less complex and does not rely on precise timing-blocks. The receiver (printer) and transmitter (computer) are synchronised by a "start bit" which is inserted before the bit-pattern for a character and a "stop bit" added after the character. Specific spacing between bytes is not required; however, it is necessary to establish the baud rate, or transmission speed in bits-per-second, between the transmitter and receiver. Commonly used baud rates are 110, 300, 600, 1200, 2400, 4800, 9600, and 19,200.

Paper-feed mechanisms

An important, and commonly overlooked, consideration in printer selection is the paper-transport arrangement. The three common transport mechanisms are friction-feed, pin feed, and tractor feed.

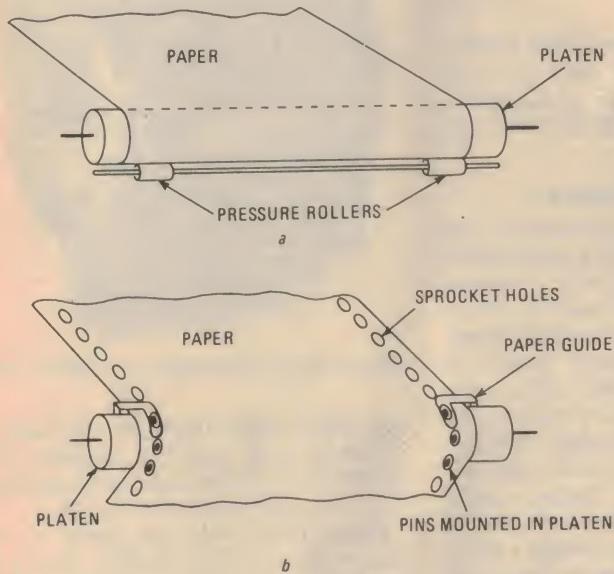


Fig. 8 Friction feed paper handling (a) works well if one copy is required. Multiple copies require pin or tractor feed (b).

In a friction-feed system, like that used in an office typewriter, gear-driven rollers hold and move the paper (see Fig. 8-a). The system is simple and relatively trouble-free, provided a single sheet of paper is used; when multiple sheets are loaded, it is not uncommon for them to become misaligned.

To solve that annoying problem, pin-feed systems (Fig. 8b) were developed. Metal pins are mounted around the outer rim of the platen and engage holes punched in the outer margins on the paper. That arrangement allows long rolls of paper (with multiple copies if desired) to be used without alignment problems. Since the pins are at a fixed distance apart on the roller, only one width of paper can be used.

To accommodate a variety of paper widths, the tractor-feed mechanism was developed. The pins in the platen are eliminated and adjustable sprockets are connected to two chain-drives that slide on rods extending the width of the paper opening. A gear train, driven by the paper-feed drive-motor, turns the sprockets, which pull the paper as a tractor would pull a cart. The sprockets can be moved and locked to handle any paper width.

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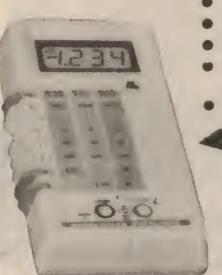
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All the latest gadgets at the . . .

Chicago Consumer Electronics Show

George Tillet, our correspondent in the United States, visited the most recent Consumer Electronics Show in Chicago and reports on some of the novel electronic gadgets being offered to the public, with computers in various guises being well to the fore. A separate report on the audio section of the show appears on page 34.

The "wonderful world of computers", in one form or another, took up a lot of space at the Show. Electronic video games are extremely popular just now, but small computers for home use are rapidly gaining a significant share of the market.

Commodore's Model 64 was described by the American Express as, "The MPU industry's most outstanding new product introduction since the birth of the industry". It can use standard peripherals and the addition of an IEEE48 cartridge will enable it to run other peripherals including CBM printers and disc drives. Another feature is its capability of using a Z-80 add-on processor board to run CP/M. The 40 column by 25 line screen and 16 colours, plus its 64K of RAM help to give it one-third more computer power than the Apple II+, at less than half the price - US\$595.

Commodore's MAX machine uses a new MPU, the 6510, to produce a variety of music and sound effects. There are three "voices" each with a 9 octave range and the instrument is said to "command amazing orchestration when used with a

good quality audio system". With a BASIC language cartridge, MAX users can learn the fundamental language of computing and write their own programs which can include maths functions.

Music Maestro Please

Casio's new musical keyboard lets the user create 1000 different sounds which are stored in 10 memories. Arpeggia patterns can be programmed to match the music by reading in up to 127 steps, nine note pitches and rests. There is a built-in "Sequencer" which allows the user to program a series of notes, play the sequence and create other sounds - all at the same time. Other features include digital frequency display, vibrato sustain, delayed vibrato and pre-set sounds for such instruments as a bassoon, pipe organ, and flute. The keyboard is a full size 61-key model.

Another musical instrument from Casio is the CT-701 computerised electronic player piano. It uses a "miracle wand" or scanner which is passed over a printed



Sony's wrist watch radio - smallest yet?

bar code music sheet so the tune is instantly put into a memory for playback. The instrument can store up to 345 notes and up to 201 chords.

Texas Instruments are giving a free subscription to the TEXNET service to buyers of their home computer package. Features of this service include market reports, commodity news service, educational programs, sports, news and information originating in the central computers of SOURCE, a Reader's Digest Telecomputing subsidiary.

The most inexpensive computer at the Show was the Timex-Sinclair Model 1000 which is made in Scotland. It costs less than \$100 and is a modified version of the Sinclair ZX-81. Among the features is a 40 key pressure-sensitive keyboard, 24 line black on white display, 37 standard graphic symbols, 2Kbyte static memory, 8Kbyte system ROM, BASIC interpreter and a built-in RF modulator.

Hardly Cricket, Old Man

Do you play golf? If so, Mitsubishi have just the gadget for you - the GL-500 Golf Trainer. It consists of a computerised display unit mounted on an artificial grass mat base. As the club passes over this base, the shot is detected by four sensors and the data displayed. This



Casio's MT-70 is a miniature keyboard instrument with fully automatic playing capabilities. The light pen scanner can read music printed in bar code form.



Golf in the computer age – the Mitsubishi GL-500 Golf Trainer.



Mitsubishi's computer controlled "Move-Master" robot arm.

includes head speed, head angle, hitting area of club, shot direction, and the difference in distance between the aimed and actual point at which the ball would land. Now if they would only make a similar device for cricket...

An interesting telephone adaptor was shown by International Mobile Machines and it is intended to screen phone calls, to tell you who is calling and it also features a memory. It works like this: whenever someone dials your number, the phone will not ring but a pleasant synthesised female voice asks the caller to enter their personal access code by pressing the appropriate buttons. If the code you've authorised is entered, the number appears on a digital display so you know who is calling and who the caller wants to speak to.

If the phone has been unattended a touch of a button displays the access codes of all those callers who have tried to reach you. The system is called "Privecode" and one of its uses is to stop people from being bothered by wrong numbers, obscene calls, and slick salesmen.

Mitsubishi were demonstrating what they called a "Micro Robot Mini Computer System" which consisted of a keyboard computer with display, plus a "mechanical arm". This is a jointed structure mounted on a base and powered by six drive motors. There are five degrees of freedom, with independent rotation around six independent axis with a multi-location memory.

The device, called a Move-Master, can be controlled by a number of standard computers but the MX-6000 was specially designed to interface. It has a 125mm green display, 64K dynamic

RAM, floppy disc, 640 character display and an impact-type dot matrix printer. Programming languages include BASIC, assembler, and a new robot-oriented language called M-Roly. What can this robot be used for – apart from handing its owner the telephone? Well, the makers say it is useful for getting practical experience in robotics (there's a new word for you!) either for the hobbyist or for education.

In Brief

Prize for the smallest radio must go to Sony's wrist watch model which uses

one-chip technology. A four-function LCD displays time, alarm time, and AM station frequency. Loudspeaker is a one-inch model... Marantz were demonstrating the "Sing Along System" which uses a cassette deck with special tapes so the lyrics of popular songs are displayed on a screen... Texas Instruments were showing the "Magic Wand" reader designed for young children. It features an optical scanner built into a "Magic Wand" to read talking book codes which are translated into "human-like" voices. The vocabulary consists of 200,000 words and there are various sound effects and songs. ☉



At the Chicago Consumer Electronics Show visitors could try everything from a game of "Dungeons and Dragons" to the latest in computer musical instruments.



FORUM

Conducted by Neville Williams

TV receivers still catch fire — occasionally!

I had thought that the subject of fires caused by TV receivers was now dead but, if so, it exhibits a remarkable disinclination to lie down! In the same week, I received in the post reports of two fires in TV receivers — one in a newspaper clipping from Port Augusta, SA, and the other in a letter from a Tasmanian serviceman.

The subject was first discussed in the May 1980 issue, in this column, following an explosion and fire in a home at Emerton, NSW. The incident had been reported widely in the popular media and built up into the proportions of a bomb scare. Without need to exaggerate, our "Forum" article in the particular issue began thus:

"If reports from the popular media are to be taken at face value, that TV receiver in your lounge room is a potential time bomb, with the ability to explode, to destroy your home, to maim and kill."

Our opinion and summation of the situation followed:

"If you're worried or apprehensive, forget it. Your emotions have been got at by well-intentioned but ill-informed people. Treated with ordinary commonsense, your TV set is no more a hazard than a hundred other things around the home."

Our "talking down" of the risk was a natural reaction to what we considered to be over-reaction to the Emerton incident, and to statements that simply didn't make technical sense. In particular, there was the much repeated claim that, if a TV receiver was not switched off at the wall outlet, power would "build up" during the idle period and be released in a surge when the set was switched on again. This could cause an explosion and fire.

However logical such a statement may sound to a non-technical reader, power just doesn't "build up" in that way.

If it did, then maybe we shouldn't be content with the wall switch either, lest power should "build up" in the wiring

embedded in the house walls! Let's turn off the power at the meter box!

But, while it is easy enough to discount unsound assertions and scare talk, that doesn't erase the evidence that TV receivers do sometimes catch fire.

And, while the incidence of such fires may be statistically very low, the fact is that they shouldn't happen at all. So faced with a couple of reports, in rapid succession, it is not unreasonable, once again, to ask why?

The newspaper report is in the form of a clipping from "The Transcontinental", Port Augusta, SA. It was under the heading "TV causes \$2000 fire" and we quote it as it appeared:

A fire, which started in a television set, caused \$2000 damage to a house in Harris Street, Stirling North on Saturday.

Mr Brenton Noll of the Stirling North CFS brigade, said one unit and nine members attended the fire when the alarm was raised at about 5.30pm.

Mr Noll said damage to the house was conservatively estimated at \$2000. Most of the damage was confined to the lounge room but the fire burnt through a wall into the kitchen, destroying a refrigerator.

The occupant, who was not at home at the time of the fire, had turned the television set off but not the power at the power point.

Mr Noll said this should serve as a warning that television sets should always be turned off at the power point.

"We have heard of fires starting like this from headquarter's bulletins, but this is the first fire we have experienced involving a television set," said Mr Noll.

Without knowing any more about the incident than is reported above, one

could scarcely offer any opinion about what happened.

It is noteworthy, however, that the Fire Officer quoted the desirability of turning off appliances at the wall switch — with the further implication that he was talking about all appliances, not just TV sets.

He did not mention the idea of a power build-up in the appliance, which is a technical fiction. But, leaving that aside, we are still left with a conflict in "official" attitude:

DIFFERENT ATTITUDES

Apparently, the Fire Authorities are still promoting the idea of switching appliances off at the wall. Presumably, it is on the assumption that it obviates the risk of failure of wiring and components in the appliance up to and including the appliance's own off-on switch.

Against this, in recent years, we have seen a proliferation of equipment which is intended to be plugged into a live power point, even when not in actual use. I refer to equipment and appliances with clock readouts, programmable on-off switches, memory dependant functions, etc. They won't even function properly unless they are so used.

Yet all of them will have been type approved by the electricity supply authorities!

In fact, as an exercise, I jotted down all the gadgets around my own home that are normally left plugged into a live power point. They clearly outnumber the few portable appliances that aren't. What's more, I don't imagine that other homes would score very differently.

Before enlarging upon those remarks, let's turn to the letter mentioned earlier, from an electronics serviceman in Tasmania. From here on, I quote the letter verbatim; except that I have deleted the brand of the receiver involved. I do so because there is nothing to indicate that there is an intrinsic problem in the particular model.

"In May and July 1980, the Forum column discussed exploding TVs and sought ideas on how the phenomenon

of spontaneous combustion might come about. The first article mentioned the old wives' tale of sets suffering from 'power build up' and eventually causing a fire. I would have thought that this idea had been well and truly scotched but I learned recently that it is still alive and well, and being promoted by people who should know better.

"A friend of mine complained one day of being 'worn out' after spending the weekend helping a neighbour clean up after a TV fire. At first I doubted that a TV could cause enough damage to require two men two days to clean up. Now I would believe anything!

"Further discussions revealed that the neighbour had been told by firemen that TVs store up power and can still cause a fire after being switched off. The neighbour was convinced that this is what had happened to his set, so I decided to stick my oar in and try to find out if the TV was being unjustly accused.

"I called on the owner and found him on the front porch sorting through books and papers which were liberally covered with greasy soot. A refrigerator stood nearby, also covered with smelly grime. I introduced myself and asked if I might inspect the remains of the TV.

"I was taken round to the side of the house and shown the carcass of the TV. It had once been a 63cm model about four years old. The chipboard cabinet had not been totally destroyed but the interior was a wreck. The picture tube had gone; only the yoke and shadowmask remained. I looked for the power switch, but the top right hand corner was a barely recognisable lump of charcoal. The slider control knobs showed which side had been the front but the back was an indescribable mess of carbon and melted plastic.

SEAT OF THE FIRE

"I identified one of the fuses and part of the pushbutton tuner, but there was no hope of finding the real cause of the fire. All that could be determined was that the fire had started in that part of the set. Away from that corner the damage was less, and the small signal board on the left hand side was charred but not burnt.

"The owner's story of the event was interesting but revealed little. They had been watching the TV without any sign of trouble, then switched off and went to bed. Between five and 10 minutes later they were startled by a loud 'whumph' from the lounge room. The owner went to investigate and had the door open only inches when he was confronted by thick black smoke and a bright red glow from the vicinity of the TV.

"The fire brigade took care of the fire, and apart from the destruction of the TV, the only fire damage to the house was a 1 metre circle of burnt carpet. However,

the smoke damage had to be seen to be believed.

"The once bright walls are now a sombre black, despite having been washed down several times. The smoke has penetrated right into the plaster. All the drapes and some of the furniture will have to be replaced — the stains just cannot be removed. The smoke even penetrated into the kitchen and cutlery in a closed drawer is covered with the same sticky soot.

"Most of the smoke damage seems to have arisen from burning plastic. The picture tube surround had melted and run onto the carpet and burned vigorously until quenched by the fire brigade. The plastic control panel was completely consumed, as was the line output board and the power supply.

HOW THE BLAZES . . . ?

"I was still interested to find out how the fire might have started, so I went home to study the circuit and manual in the hope of finding a clue. The mains cable goes first to a double-pole switch, then to a pair of 5-amp fuses and a mains filter assembly. I would expect that the fuses would take care of a fault in the filter or another part of the set, even if power could get past the double-pole switch. So I decided to look into the possibility of a faulty switch. What follows can only be conjecture, because the switch didn't survive the incident.

"The set is switched by a special type of unit carrying the usual pair of power contacts and a single momentary make contact. I have never had trouble with this type in the particular set, but I have had to replace similar switches in other TVs because of loose contacts. The contacts pass through a small strip of PCB materials and are twisted to hold them in position.

"The active and neutral leads are separated on the switch body by about 1cm, but there is no barrier between them. If there was a stray wire on the soldered terminal, compounded by a loose contact, one could imagine the gap being reduced to a distance that could promote dust build-up. Tracking could then start between the active and neutral, leading to a general heating of the switch body. Then, at switch off, the loose contact could possibly spark, igniting the already hot switch body.

"I realise that this scenario is stretching credibility, but it's the only thing that can explain how the TV caught fire when switched off by an effective double-pole switch.

"I think the TV as such can be absolved from blame for this fire. The answer has to be a switch fault. The only other possibility would be a power supply fault but the fire didn't start there.

"Incidentally, the noise that alerted the

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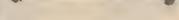
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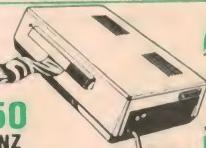
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owner was the picture tube breaking. Parts of the faceplate were found across the lounge, 4 metres away from the TV. So rim banded tubes are not always safe!"

J. L. (Geilston Bay, Tas.)

A word of thanks is due to J. L. for the most detailed report we have had to date on a "fire bomb" TV set.

His conclusion? As far as he could see, it was a case of tracking and arcing across the works of a double-pole mains switch, generating enough heat to set fire to nearby combustible substances.

If that was the case, the risk is not peculiar to TV receivers. Around my own home as I said earlier — I can think of quite a few units which are normally turned on and off by their own switches: TV receiver, VCR, hi-fi amplifier, tuner, tape deck, phono player, electronic organ, clock radio, electric blankets and sundry lamps.

Considered Australia-wide, that kind of list must add up to an enormous number of off-on switches built into appliances. By comparison, the number of switch failures leading to fires must be statistically minuscule.

But try telling that to someone who has just been through the kind of experience related in J. L.'s letter. Or, for that matter, to a fireman who has just had to squirt water and foam over a family's treasured possessions!

Maybe the message for the rest of us is to be less impatient with the bureaucrats who seem to spend long hours fussing about the fine points of mains wiring, terminations, anchor points, switches and so on. Maybe, without realising it, we have a few things to thank them for!

Also to do with the mains, I have a let-

ter to hand from a reader in Western Australia. It has nothing to do, directly, with the foregoing discussion on fire safety but is probably prompted by earlier debate about alleged equipment failure in that state. The problem of high mains voltage was specifically mentioned by correspondent K. C. (Fremantle, WA) on page 28 of the July '82 issue.

The most recent letter reads:

It may be useful to the discussion of voltage levels in WA to point to the limits prescribed by Australian Standard ASC1 — Standard Voltages and Frequency — to which Australian Authorities are subject. (At least I believe so.)

The nominal phase to phase voltage in WA is 440V, giving a phase to neutral voltage of 254V. The above standard allows a voltage variation of $\pm 6\%$ from the nominal. So a supply voltage of 269V (or 270V as described by K. C.) is allowable.

It would be interesting to know if electronic equipment designed for 240V can tolerate a continuous 270V. This is of obvious concern to users of such equipment in WA.

R. E. (Swan View, WA)

By way of comment, I have been reminded from time to time that the mains voltage is nominally higher in Western Australia (254V) than in the eastern states (240V). As I recall, this was the main reason why Australian power transformers once had a 260V extension to be the primary winding, giving the manufacturer/vendor the option of changing the power input wiring for use in WA or in areas where over-voltage was the rule rather than the exception.

Nowadays, Australian-made equipment tends to the exception rather than the rule and R. E.'s question really boils

down to a matter of how tolerant current Japanese/Asian equipment is to high mains voltage — to say 270V AC.

Asking around, there seemed little doubt that the major importers were aware of the matter, but not conscious of any present problem.

One executive admitted that there had been some problems "early on" when step-down transformers, motors and fans took unkindly to a combination of reduced frequency (50Hz instead of 60Hz) and increased voltage (240/250 instead of 220). But that was a long time ago, he said, and "nowadays Tokyo knows what we need."

"All our gear is intended to operate on 240/250V $\pm 10\%$... I think! That would be ... er ... 275V, which would take in the WA figure!"

A service executive from another company was rather more outspoken. He would be apprehensive, he said, about equipment brought privately into Australia with 110/220V mains transformers. Whether they would cope with WA voltages would be anybody's guess.

On the other hand, "Australianised" equipment marketed by major distributors would be designed for local mains voltages, in their case up to 300V AC.

Presumably, the power input circuitry can cope with an appropriately wide range of mains voltages, while internal voltage regulation looks after the critical DC levels. At least, in that respect, modern equipment is significantly ahead of the primitive supplies of bygone days, where you got out, pro rata, what you put in.

But, frankly, I'd like to leave the question open. While it is easy enough for executives in the eastern states to say "no problem", people on the spot might have quite different ideas.

How would you answer R. E.?

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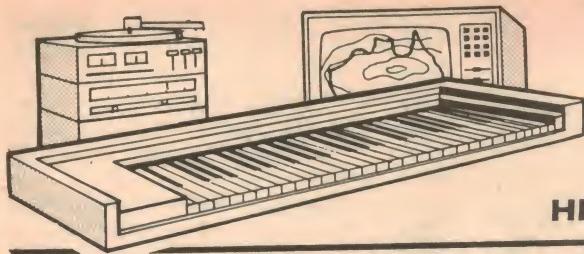
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George Tillett reports on the Chicago CES

Major exhibitions are a routine part of the American audio-video scene and the most recent Consumer Electronics trade show in Chicago lived up to best expectations with a record 72,000 visitors attending. They came to see the wares of over 1000 exhibitors in the huge McCormick Centre and in various hotels around the city.

Overall, the mood of the industry was one of cautious optimism, with most dealers looking for increased business as the political and economic climate (hopefully) improves.

As with other recent shows, the visual emphasis was on video – a term which now takes in computer-based electronics games, many of them embellished by synthesised speech.

But the big video news was from RCA, with the introduction of an advanced V-disc player featuring infrared remote control, a fast search speed (16X) in both directions, rapid access (120X) and stereo audio tracks with CX noise reduction. Similar advanced models using the RCA CED system were being demonstrated by Zenith, Toshiba and Hitachi.

RCA's Vice President, Thomas Kuhn said: "Despite the recession, US consumers spent more than \$90 million for CED players and discs in the product's first year."

The rival VHD system was being promoted heavily by Panasonic and JVC,

with programs in NTSC, PAL and SECAM. But actual commercial release has been postponed yet again!

The third system – Laservision – was represented by Pioneer and Magnavision, among others, with new models also featuring CX audio noise reduction.

Despite the visual dominance of video, there was plenty to grab one's interest in the audio-hifi field.

AR were demonstrating their new digital signal processor which compensates for loudspeaker/room deficiencies, more or less like other units which have appeared on the market recently. (See the dbx Equaliser and the Sansui Compu-Equaliser in our May '82 issue, pp 30-31. Editor.)

The AR unit is built around a central microprocessor chip, type TMS9995. The user has a hand-held control unit containing a high quality microphone.

In use, the listener presses a re-set button on the control unit, which causes a (presumably pink) noise signal to be fed through the amplifier to the

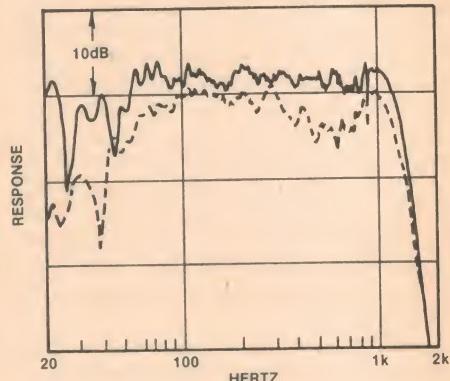


Fig. 1: A new signal processor from A&R compensates for loudspeaker and listening room deficiencies in the range up to 1kHz. The above curves show the acoustic response before (dotted) and after compensation.

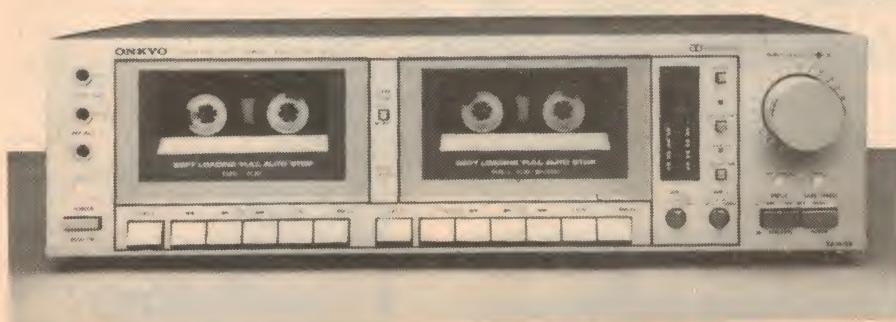
loudspeakers, one channel at a time. The sound is picked up by the microphone, converted to digital information and compared in the microprocessor to the original signal. Filters in the left and right signal paths are adjusted automatically to compensate for the discrepancies.

The system operates over the lower end of the spectrum only, up to 1kHz, and a typical set of before/after compensation response curves is shown in Fig. 1.

CASSETTE DECKS

Last year Onkyo introduced a double cassette deck; this has now been joined by a "second generation" model, with other twin decks from Sansui, Hitachi, Sharp, JVC and Technics. Most offer a fast speed option for dubbing, so that a single side of a C.60 can be copied in 15 minutes.

Perhaps the most significant development in cassette decks is a revival of interest in microcassettes. Panasonic make a miniature model using dbx, while Sony's TC-MR2 is described as "the first home microcassette deck". One of its advertised functions is to make tapes for personal microcassette players. Few pre-recorded microcassettes are available at present but this situation could change quite soon.



Onkyo's double cassette deck has a play-only section on the left and a full record/play section on the right. With bias selection, Dolby and mic facilities available, it can be used as a normal domestic deck, but with direct 1:1 copying as an additional feature. Copies made at double speed typically sacrifice a small amount of top-end response. Other manufacturers are offering similar models.

Meanwhile, blank microcassettes using metal formulations are being marketed by Sony, Fuji and TDK, among others.

Yamaha's new M-70 power amplifier features the Yamaha "X" power supply which uses the signal to control the amount of supply current. A newly developed circuit called "ZDR" is claimed to cancel distortion originating in the output stages. Rated power output is 250 watts per channel into 8 ohms with less than 0.002% THD. Incidentally, ZDR means Zero Distortion Rule.

Maybe 250 watts is a lot of power – but here are some of the design features of Harman Kardon's Citation XX power amplifier, which was designed by the Finnish expert in amplifier esoterics, Matti Otala:

- An instantaneous current capability of 200 amps so the amplifier can deliver 14,000 (yes, fourteen thousand!) watts per channel into a 0.35 ohm resistor under transient conditions.
- A low value of negative feedback.
- A dual power supply with a total capacitance of 80,000 microfarads.
- The use of three thick copper plates to form a low impedance transmission line from the power supply to the output transformer.

Rated power output is 440+440W into 4 ohms with no more than 0.1% THD. A unique feature which might appeal to the purist is a three-position switch for bias so the current can be adjusted according to the power level desired.

Last year, Denon proudly introduced a 200 watt "Pure Class A, No-Feedback" power amplifier and they now offer a matching preamp. This is the PRA-6000, which also uses no feedback. Equalisation and tone controls use passive circuits while the input switching is electronic, which eliminates "switching thumps". Price is a pretty steep \$3000!

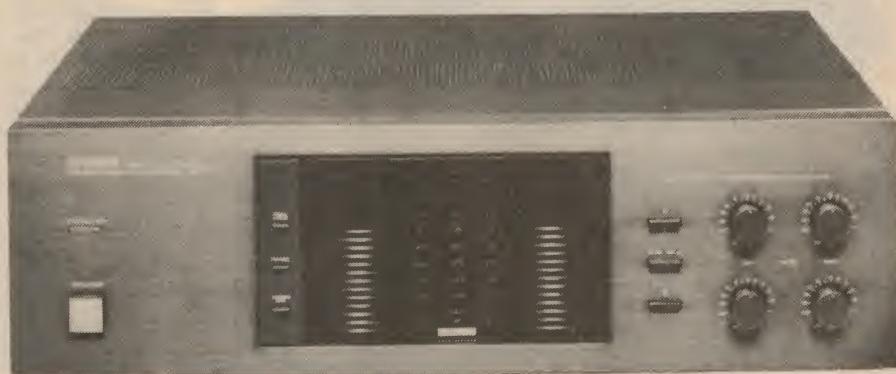
HIFI RECEIVERS

There seem to be two main trends in receiver design, a move towards combination TV-AM-FM models which is just beginning, and an emphasis on such features as quartz synthesised tuning, digital display and other refinements for medium priced receivers.

For example, Sony's low-priced (\$250) model can put out 30+30W at less than 0.03% THD and uses a novel tuning system called "Direct Access". Similar to



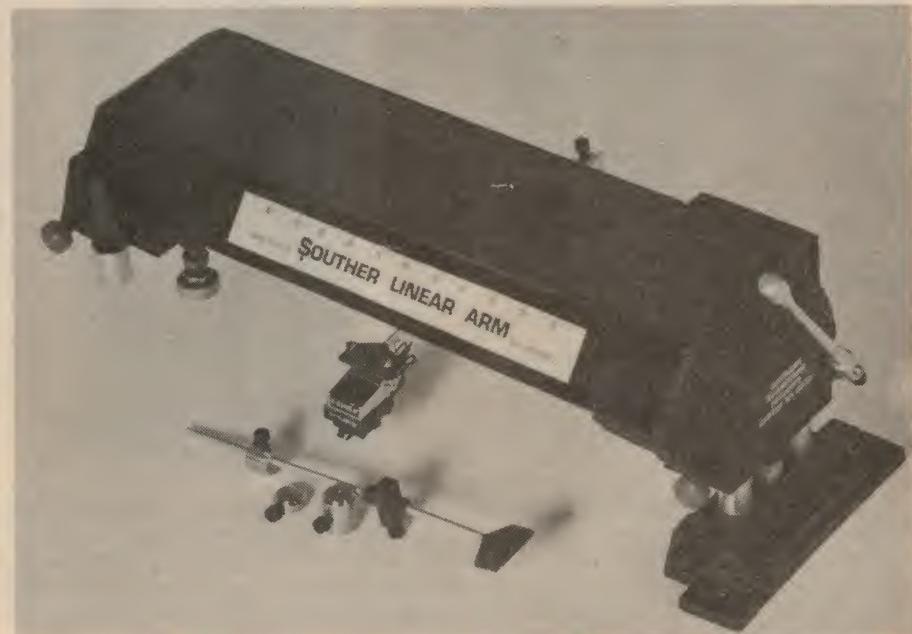
The Technics RS-M212 double deck is expressly designed for making microcassette copies of compact cassettes — an activity that has proliferated overseas with the use of microcassette players. The compact cassette section is high quality replay only. Specifications for the microcassette section, with metal tape, claim a response to 15kHz at 2.4cm/s, S/N ratio of 53dB, and wow & flutter of .08% (WRMS).



For those who fancy rather more than the usual amount of output power, Yamaha are now offering this M-70 "Natural Sound" amplifier, boasting a power output of 250+250W, with less than .002% distortion. The switches and knobs at the right permit the selection and sound level adjustment for two pairs of loudspeakers.

a calculator keyboard, it controls AM and FM tuning and memory pre-set tuning, as well as function selection. Model number is type STR-VX22 and I ought to mention that it has quartz frequency synthesis with digital display. Sansui's new top of the line receiver is

the Z-9000 which has a 120+120W rating. It uses the special "Feed-Forward" no feedback circuit, as employed in several Sansui amplifiers. Among the features is a preamp for MC cartridges, a 7-Band graphic equaliser, built-in reverb amplifier with 0 to 3 seconds delay, soft-



Southern Engineering Products would seem to have achieved the unlikely, if not impossible, with their Southern Linear Arm. It is a linear tracking system which employs no servo drive. The cartridge pulls it along as it follows the groove.



Several companies were exhibiting small loudspeaker systems for use in small rooms, caravans, etc. The pair on the left is from AR, type AR 1MS.

touch electronic volume control, mic mixing and a digital that doubles as a clock. A program timer is operated by a 10 button digital touch pad.

Bob Carver was cheerfully demonstrating his "miracle FM tuner" which is now in production. Not only is the sensitivity higher than average but the patented charge-coupled detector circuit eradicates multi-path distortion which can be a nuisance in large cities like New York.

Full details are not available but it is known that the circuit depends on the phase relationships between L and R channels. But it certainly works and works well. Stations that were too distorted to even understand the call letters were received with complete clarity at a touch of a switch!

The new Quad tuner is said to use, "Good ergonomics and advanced electronics to produce a tuner with exceptional audio performance and ease of handling". It has no controls, apart from the pre-set buttons, power switch and tuning knob. There is an integral microprocessor that stores the tuning information for each pre-set station and holds it for as long as five years, even if the unit is disconnected from a power source!

PHONO DECKS

Turntable prices are still coming down and there is now quite a choice in models priced well below \$150. As expected, there were several new linear tracking designs from manufacturers like Sansui, Luxman, JVC and Technics.

The most unusual was a precision linear arm from Southern: unlike all the other models now on the market, it doesn't use a servo drive mechanism as the record groove pulls the cartridge along and just like a conventional pivoted arm. In order to do this, arm

friction is very low indeed, so is the mass. It is actually made from a glass composition and weighs only 1.25 grams. A three-point suspension is used with stainless steel and sapphire bearings and it runs on 100% pure quartz rods.

Yet another unusual arm was the Townsend "Elite" which is a pivoted design with a difference. An extension section near the cartridge floats on an



This picture of the Acoustat ESL model Eight loudspeaker gives no hint of its true size but it is actually 239cm tall or, if you prefer, almost eight feet! The potential sound pressure level in a room is no less impressive.

arc-shaped trough filled with silicone to provide damping. This is done very effectively and the turntable base can be hit quite hard before mistracking occurs.

One of the issues causing argument among engineers is the proposed AM stereo transmissions. There are no less than five systems contending for acceptance: Magnavox, Belar, Harris, Kahn and Motorola. All employ some kind of phase modulation but the Kahn system has independent left-right sidebands while the Belar approach is to frequency modulate the carrier. The other three systems phase modulate the carrier.

Most of the Japanese manufacturers appear to favour the Magnavox system, although the Harris system, which was demonstrated at the Show, has several advantages. It has a wider bandwidth, separation up to 15kHz and the smallest occupied bandwidth. At the Show, Sansui were demonstrating a receiver equipped to receive signals from a local transmitter in the Kahn, Harris and Magnavox modes.

NOISE REDUCTION

Arguments are still going on, also, concerning the compatibility of the CBS CX noise reducing system. Fewer than two dozen CX records have been released, although some 200 are promised by the end of the year. Several receivers were to be seen featuring CX and a number of decoders are now available, while the system is being used in V-Disc players and VCR's.

I counted 17 compact digital disc players at the Show but only one company, Cybernet claim that units are being actually produced. The software situation is not too clear, although Polygram claim that they will release 200 to 300 records by the end of the year.

LOUDSPEAKERS

AR, as well as demonstrating the digital equalising system, also introduced a pair of loudspeakers in the Lambda range. A common magnet structure is used for the midrange and treble units so the dome diaphragms can be placed close together, only 50mm apart from centre to centre. This distance is less than the wavelength in the crossover region, so there are no phase aberrations. Hence the name Lambda, which in this context means "wavelength".

The AR9LS has two bass drivers, a 30cm and a 25cm model, while the AR98LS has a single 30cm unit.

JBL has a rather interesting four-way floor standing system which was in the shape of an asymmetrical pyramid, some 107cm high. The bass driver is a heavy-duty 36cm model with a 10cm voice coil and the midrange speaker is a 20cm

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the SA and SA-X series for high bias position and the MA and MA-R series for metal position.

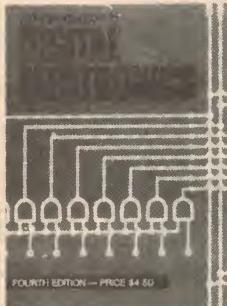
"TDK does amazing things to my system."

Note: Any person practising tape-recording should observe the provisions of the Copyright Act 1968.

John Bevins TDK 05

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Electronic equipment now plays an important role in almost every field of human endeavour. And every day, more and more electronic equipment is "going digital". Even professional engineers and technicians find it hard to keep pace. In order to understand new developments, you need a good grounding in basic digital concepts, and An Introduction to Digital Electronics can give you that grounding. Tens of thousands of people — engineers, technicians, students and hobbyists — have used the previous editions of this book to find out what the digital revolution is all about. The fourth edition has been updated and expanded, to make it of even greater value.



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Fundamentals of Solid State has been reprinted, revised and updated showing how popular it has been. It provides a wealth of information on semiconductor theory and operation, delving much deeper than very elementary works but without the maths and abstract theory which make many of the more specialised texts very heavy going. It begins with atomic theory, diode types, unijunction, field effect and bipolar transistors, thyristor devices, device fabrication and microcircuits. A glossary of terms and an index complete the book. Fundamentals of Solid State has also been widely adopted in colleges as recommended reading — but it's not just for the student, it's for anyone who wants to know just a little bit more about the operation of semiconductor devices.

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"Electronics Australia", 57 Regent St, Chippendale. PRICE \$3.50 OR by mail order from "Electronics Australia", PO Box 163, Chippendale, 2008. PRICE \$4.40.

AUDIO-VIDEO ELECTRONICS — continued



Said to be the first home stereo microcassette deck — a claim that might be open to dispute — this Sony TC-MR2 has the normal range of facilities expected of a modest compact cassette deck. It has provision for normal and metal tape, connections for line, mic and headphones, and includes a tape counter plus twin level meters.

type. Upper midrange frequencies are handled by a 12cm cone unit and a 25mm dome tweeter takes care of the high frequencies. Power handling capacity is 400 watts.

Smallest system in the range is the L-15, which measures only 375mm by 248mm by 178mm deep. It has a 160mm bass driver with a 25cm dome tweeter.

Other high quality mini-systems were shown by AR, IMF, Onkyo, Celestion, Panasonic and Jantszen — the last named using electrostatic elements for mid and high frequencies.

One of the best demonstrations at the

Show was given by B&W with a new mini system measuring less than 250mm by 200mm by 178mm, which was designed for home or car use. Bass driver is a long-throw 100mm model and it crosses over at 3kHz to a three 19mm dome tweeter.

The Quad ESL-63 electrostatic system excited some interest, as did the latest full range ESL model from Acoustat. Their Model Eight stands 239cm high! Radiating area is more than 2sq m and it can put out a SPL of 125dB at about 8m in an average room. It weighs no less than 100kg, definitely not the system for a small apartment.

NEW FISHER HIFI SYSTEM RELEASED



System 550 is the first of the new full-scale hifi systems to be released in Australia. It incorporates a class A2 amplifier with an 80W rated output and a THD of not more than 0.009%. A full range of facilities is provided, together with a 12-band graphic equaliser. The tuner is a quartz locked synthesiser type with presets for 6 AM and 6 FM stations. Phono deck and cassette are both high performance direct-drive types and the loudspeakers are 3-way. For further information, contact Sanyo Aust Pty Ltd, 225 Miller St, North Sydney 2060. Tel: (02) 436 1122.

JBL: Suggested demonstration records

The distributors of JBL hifi products have circulated the following list of records which, they say, are noteworthy for their technical excellence. They may be expensive and difficult to obtain and find but most of them should be obtainable through record and hifi shops carrying audiophile discs.

1. Lincoln Mayorga and Amanda McBroom, **Growing Up in Hollywood Town**, Sheffield Lab 13. Vocals are beautifully recorded, and instrumental timbres are quite natural. "The Rose," played at a slightly elevated level, will really put a speaker through its paces.
2. Gino Vanelli, **Powerful People**, Mobile Fidelity MFLS1-041. Superbly produced male vocal album. Listen for clarity and transparency in the vocal lines.
3. Earl Klugh, **Finger Painting**, Mobile Fidelity MFLS1-025. Beautiful pop/jazz arrangements with lots of naturally recorded percussion details. Also available from Mobile Fidelity in UHQR "Super record" format.
4. **Take the A Train**, Toshiba-EMI LF-95011. This Japanese import is one of the best direct-to-disc productions ever made! It aptly demonstrates that big-band jazz is alive and well in Japan. Wide dynamic range with no limiting.
5. Handel, **Messiah Choruses**, Argo ZRG-872. This recording, by the Academy and Chorus of St Martin-in-the-Fields (cond Neville Marriner), arrays the choral sections left, left-centre, right-centre, and right. Listen for precise imaging and natural balances throughout.
6. Bizet/Grieg, **Carmen and Peer Gynt Suites**, St Louis Symphony, Leonard Slatkin, cond Telarc 10048. All the Telarcos are good, but this one excels in its lovely balance between orchestra and hall acoustics. Wide dynamic range.
7. John Klemmer, **Finesse**, Nautilus NR-22. A fine direct-to-disc production. Klemmer's tenor sax is backed up by some of the best studio musicians, and the pick-up is quite natural.
8. **Cantate Domino**, Proprius PROP 7762. This Swedish choral and organ record, made in a large church with only two microphones, demonstrates just how simple it is to make a superb recording — if all the ingredients are right. The feeling of space is uncanny, and the disc is about as distortionless as you can find.
9. **Jazz at the Pawn Shop**, Proprius PROP 7778-79. This two-record set, also from Sweden, exhibits a basic two-microphone approach, this time in a small jazz club. Instrumental timbres and imaging are excellent.
10. Dave Grusin, **Discovered Again**, Sheffield Lab 5. Grusin's Jazz piano is backed by bass, drums, guitar, and percussion in one of the most enduring direct-to-disc albums ever made. Wide dynamic range and natural timbres are the high points.
11. Karla Bonoff, **Restless Nights**, Columbia JC35799. Vocals and guitar instrumental are extremely natural and are excellent demos of midrange clarity.
12. **The Sheffield Drum Record**, Sheffield Lab 14. Guaranteed to "break" marginal speakers! No record ever made exhibits so high a peak factor. Stunning in its impact.

In brief . . .

CONCEPT AUDIO have received stocks of a new model Dynavector tonearm designated as model DV-501. They indicate that it is similar to the existing DV-505, in that it is a "biaxis inertia controlled structure with electromagnetic damping system." The DV-501 has a built-in arm lifting device and, unlike its "big brother", can be installed on a Rega turntable, without touching the lid. Recommended retail price is \$450.00. Concept Audio is at 22 Wattle Road, Brookvale, NSW 2100. Phone (02) 938 3700.

HANIMEX PTY LTD have put together a \$279 "package deal" for prospective buyers of a high output car stereo system. Based on the Japanese Roadstar range, it offers a 40-watt radio-cassette system, with five-band graphic equaliser. The equipment is compact enough to fit into many

vehicles, without the alterations which are often needed to accommodate high output stereo systems. Quick program search facilities on the cassette deck, plus auto rewind, minimise distractions for the driver. The loudspeakers are two-way coaxial types with flush mounting door fittings. Inquiries to Brent Whyte, Hanimex Pty Ltd, 108 Old Pittwater Road, Brookvale, NSW 2100.

CONCEPT AUDIO, who distribute Milty products in Australia, are now carrying "Permclean". a fluid cleaner which the manufacturers say can remove organic and inorganic fouling from the surface of a record, along with microdust particles from the grooves. Associated record care devices are a "Duo Pad" double-sided buffering pad and a rubber Work Mat. For details: Concept Audio Pty Ltd, 22 Wattle Road, Brookvale, NSW 2100. Phone (02) 938 3700.

SILVERTONE NEWS

Newsletter of Silvertone Electronics
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A completely new approach to small (up to 1.5 metres) ROBOTIC PUPPETS

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**MASSIVE PRICE
BREAKTHROUGH!!!**

A Sub-Woofe System makes a lot of sense. Apart from getting down to a genuine 30Hz you could actually save money over all. For years we have been persevering with huge 12" 3 or 4 way systems in up to 120 litre cabinets to try to get down to — at best 45Hz. We have even duplicated our effort by having a stereo pair for this frequency!!! Big 12" systems don't come cheap. With a Sub-Woofe you can forget about what happens below the non-stereo <100Hz region. Once that's done you are free to use a very compact (and generally far cheaper) system for stereo. Concert hall sounds in your lounge room without needing an auditorium to house your speakers!!! The profit you make from selling your 12" system could pay (or even exceed) the cost of the Sub-Woofe system. — AND you can get down to 30Hz!!!

1812 LIKE NEVER BEFORE. So too those big pipe organ records. This system is a must for the direct or digital disk enthusiast. Now that "ELECTRONICS AUSTRALIA" have designed *a Mosfet Sub-Woofe filter/amplifier and speaker system you have no excuse.

JAYCARS' BULK BUYING PASSES SAVINGS ONTO YOU. TRULY A PRICE BREAKTHROUGH FOR SUB-WOOFER SYSTEMS.

*(With due respect to Thiele, Small, Snyder and others!)

THE SUB-WOOFER MODEL SW 250



ONLY \$79.50

This unit has been extremely popular with audio enthusiasts right across Australia. EA have designed a special crossover/booster amp just for this unit. Now you have no excuse to build a subwoofer system to enjoy those thrilling low notes from pipe organs, synthesizers, 1812 cannons etc!!

SPECS:

Diameter 10" (250mm) Cast Frame. QT=0.39. VAS=631 Power Handling = 100WRMS. Free-air Resonance 32Hz ±1Hz Voice Coil = 2" (51mm). Dia. Magnet Assy = 3kg (6.6lbs). A FREE SUB-WOOFER CABINET DESIGN IS PROVIDED WITH EACH UNIT!!

THE ENCLOSURE



ONLY \$79.50

This compact 63 litre vented enclosure was specifically designed around the parameters of the SW250 Sub-Woofe. It follows the theory pioneered by the work of Thiele, Small and Snyder. The Jaycar enclosure is easy to build and is made of high quality durable materials. The heavy walled cabinet is covered with an attractive black vinyl veneer. All timber is pre-cut and the black grille is already made. Assembly takes less than one hour. NB. The photo shows the prototype which was finished in white. The production units are only available in black Freight anywhere in Australia only \$10.00.

AMPLIFIER/FILTER UNIT



REF. EA JULY 1982

State-of-the-art power Mosfet technology combined with an active low pass filter results in a sub-woofer amp without equal anywhere!!

FEATURES: Around 100WRMS Drive capability. Low pass (sub-woofer) filters on board. Can hook-up to pre-amp out or power-amp out. Power supply on board.

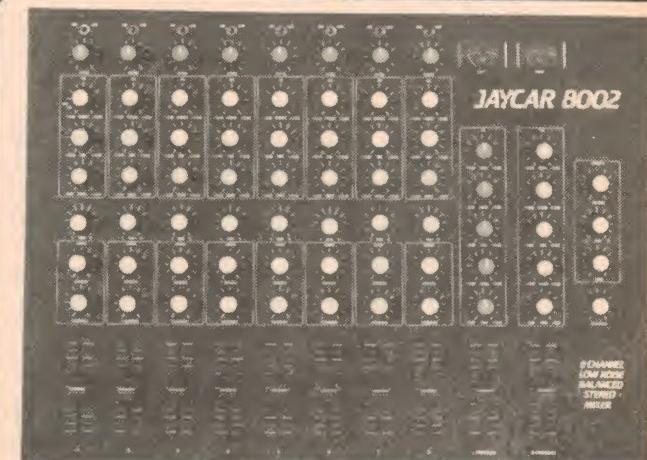
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AMPLIFIER/FILTER
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Metal case specially made to suit including front panel, hardware etc. (not e twin 28 case). Only \$29.50
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Ref. EA July '82
Extremely useful circuit, has dozens of applications.

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- Signal-to-noise Microphone input -75dB with ref to +4dBm
- Signal-to-noise line input -90dB with ref to +4dBm
- Line out level +4dBm (0VU)
- Distortion less than 0.005%
- Power requirements 240VAC 50Hz 25 watts

dimensions

Width 483mm
Height 355mm
Depth (console/mount) 150mm

- Balanced (600 Ohm) Mic. Inputs/Line Inputs.
- Cannon Connectors included in the price.
- Bass, Mid & Treble Equalization on each Input.
- "Effects" (i.e. Echo etc.) capability.
- Foldback and Stereo Pan on ALL 8 Inputs.
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- Professional Black Front Panel with Format borders & multi-coloured knobs to assist function identification.
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"BLACK MONOLITH"

SPECIFICATIONS

POWER OUTPUT

FREQUENCY RESPONSE

Around 100W RMS into 8 ohms

8Hz to 20kHz, +0 - 0dB

2.8Hz to 65kHz, +0 - 3dB

Note: these figures are determined solely by passive filters

1V RMS, for 100W output

-10dB below full output (flat)

-116dB below full output (flat, 20kHz bandwidth)

<0.001% at 1kHz, 0.0007% on prototypes) 100W

output using a 56V supply rated at 4A continuous

<0.003% at 10Hz and 100W

<0.0003% for all frequencies less than 10kHz and all

powers below clipping

Determined by 2nd harmonic distortion (see above)

<0.003% at 100W (50Hz and 7kHz mixed 4:1)

Unconditional

In "2001" Arthur C. Clarke's Black Monolith symbolised awesome power — intelligence.

So too do the 5000 "BLACK MONOLITH" Power Mosfet amp kits from Jaycar.

Why would you choose a Jaycar "BLACK MONOLITH" 5000 Power amp over conventional kits? Because you, too, are intelligent.

You have seen the specs, and you know that this amp IS the best. You want the best because (whether you know it or not) you are a perfectionist. You won't be conned by cheap and nasty compromises to David Tillbrook's brilliant design. You will want to know if there have been mods to the original design. (There have — and only Jaycar kits reflect them). But let's be specific about the improvements.

— Completely redesigned flagheatsinks for the Driver Transistors. Thoroughly endorsed by David Tillbrook. (The original ones were too small if the bias current was set high for low distortion).

— Ventilation grilles in the covers. These were not included in the original design.

— Blind tapped holes in the exclusive "Superfinish" front panel. Heavy gauge screws used for stronger connection of the heatsink bracket to the panel.

— Jig drilled, EXTRUDED, deburred and black anodised heatsink bracket in heavy gauge. All other kits we have seen, a flimsy punched out piece of sheet metal is supplied. Not even anodised!! This is one of the most critical components in the kit.

ONLY \$299—
PAY NO MORE!!!

8 CHANNEL
MIXER
8002 PRICE
BREAKTHROUGH!!!

The Jaycar 8002 Mixer was originally conceived to be the successor to the very popular ETI 414 Master Mixer. The 414 was basically configured as a 'stage' mixer and suffered from a number of severe technical limitations — notably poor signal-to-noise figures. Enormous advances in Audio IC's have occurred since the 414 was designed. Jaycar engineers have taken advantage of this. The incredibly low noise and distortion figures of the 8002 are a testimony to the sound basic design of the mixer coupled with the performance capability of these IC's. While the 8002 is the ideal 8 channel compact stage mixer, other applications have been kept in mind. AS A "STUDIO" MIXER: The prime requirement of a studio mixer is that it must be quiet — i.e. have good S/N. Due to the fact that the "miracle" 5534 IC's are used in the 8002 studio applications are entirely feasible.

In addition this, metal film resistors are used in critical signal areas.

AS A DISCO MIXER: The balanced input feature of the 8002 is not really necessary for disco use. This

can easily be bypassed with either a moving magnet (Dynamic Cartridge) preamp, or a moving coil preamp.

The sensible format of the 8002 and tremendous equalization facilities should make this mixer popular for disco use.

AS A STAGE MIXER

This is where the 8002 really excels. The 8002 front panel measures 19" wide x 14" high (8 rack units). This enables the 8002 to be mounted into PA equipment racks if necessary. Strikingly speaking, the chassis is not needed in this configuration although the chassis is also rack mountable. The 8002 can also console mount with attractive heavy timber end pieces adding to the appearance of the unit. Powerful "Sends" capability is built into this mixer. Both special effects (echo) and foldback for the stage performers can be sent FROM ANY ONE OR ALL of the 8 input channels. Fully variable calibrated sends attenuators are provided on each channel. Sends can be panned across the stereo image to create spectacular special effects. You could, for example, pan a pre-recorded tape of a steam train rushing from the left hand side of the stage — across — and exit stage left with this facility. Balancing sorts the monitor output from the toys. With the 8002 you can take either a microphone level input or a line level input into any of the 8 channels. An input selector switch is provided at the top of the mixer panel. Another attenuator is provided at this point to prevent over load of the input circuitry should the microphone level be higher than normal microphone or line levels. Each input channel has 3 band equalisation capability with a massive 12dB boost or cut. A pan control enables each input channel to be panned left thru right across a stereo image. Inputs out of stereo position on a stage can be compensated in the mixer. Finally a quality 60mm slide fader control is provided. We felt that in keeping with the professional nature of this instrument that the extra resolution that the larger control offers is warranted. METERING: The left and right monitor channels have VU metering. Also provided is a 5-band Graphic Equaliser (+/-9dB). An optional LED peak-metering circuit will be available shortly. Master foldback send is also provided.



— Beryllium Oxide heatsink washers supplied. A tube of heatsink compound is also supplied — with enough left over to use elsewhere.
— Superfinish® Front Panel. Despite what others may claim ours is still the best.
— Dual 3 Pin DIN 30V Power Outlets. This extra power outlet enables you to power extra 5000 series components as they arrive on the scene.
— And all of the extra features of our normal Superfinish 5000 amp, like, Metal 1% film resistors, Pre-wound Chokes, Fibreglass PCB's, Heavy Duty Earth Braid, Quality Capacitors, Original Chassis bar design, Flux shorting straps on transformers etc., etc.
The Jaycar "BLACK MONOLITH" is worth far more than the inferior kits around the market today. That goes without saying.

BUT IT COSTS NO MORE!

That's right. FOR THE MOMENT we are holding our price on this kit to a staggering low \$299. We probably won't be able to keep this quality kit below \$300 for long. We all enjoyed '2001' for the first time a long time ago now. You can enjoy your 5000 "BLACK MONOLITH" forever!

"BLUEPRINT" 5000 PREAMPLIFIER



BLUEPRINT \$275

The refinement continues. This silk screen etched front panel is renewed after every run of 20 panels. This ensures the crispest possible etching. Note: ONLY JAYCAR use the ORIGINAL ETI front panel design. Don't get caught with something you may not like the look off! We use the extra high quality LM394H in the M.C. preamp, and now AT NO EXTRA CHARGE supply gold plated RCA sockets on all inputs, not just the M.C. Input.

Despite what others may say, their's is not as good as the original BLUEPRINT Preamp. They do not, for example, get special low capacitance screened cable made to Jaycar specs. just for the preamp. (It's made in Australia, not Taiwan).

AND OTHER FEATURES OF THE BLUEPRINT:
— EXTREMELY CLOSE TRACKING TO RIAA EQUALISATION.
— ENGLISH 'LORLIN' LOW NOISE SELECTOR SWITCHES USED.

— LOW NOISE 1% METAL FILM RESISTORS USED
— TINNED F/Glass PCB'S

We still have the standard \$245 version of this kit which is better than the other \$245 kits. We don't sell many though... the BLUEPRINT is better value. 'BLUEPRINT' ONLY \$275.

SPECIFICATIONS

Frequency Response: High level input: 15Hz to 130kHz +0, -1dB

Low level input — conforms to RIAA equalisation +0.2dB (see detail on Phone spec.)

Distortion: 0.003% (at 1kHz, 10mV RMS input, 100 ohm source resistance connected)

S/N noise: 30dB (at 1kHz, 10mV RMS input, 100 ohm A-weighted)

MC input: master full, with respect to full output (1.2V) at 5mV input, 500 ohm source resistance connected 86dB flat

MC input: master full, with respect to full output (1.2V) and 500V input signal 92dB A-weighted

MC input, master full, with respect to full output (1.2V) at 5mV input, 500 ohm source resistance connected 86dB flat

MC input, master full, with respect to full output (1.2V) and 500V input signal 92dB A-weighted

ETI 478MM Moving Magnet input stage Gain Frequency Response Total Harmonic Distortion Noise

24 7Hz - 135kHz +0, -1dB 0.003% 1kHz, 10mV RMS input

Gain Frequency Response Total Harmonic Distortion Noise

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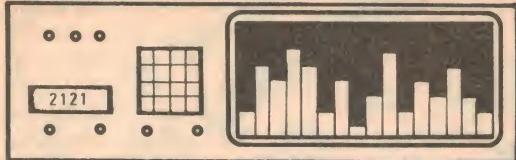
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Gain Frequency Response Total Harmonic Distortion Noise

24 7Hz - 135kHz +0, -1dB 0.003% 1kHz, 10m



HIFI REVIEW

New slimline quartz/digital AM/FM tuner

Technics may well have put the hifi cat among the pigeons with the release, this month, of their new ST-Z45 AM/FM-stereo tuner. Attractively styled, and with full quartz synthesised, digital display circuitry, it is destined to sell in Australia at just over \$200.

This reviewer's first encounter with the ST-Z45 was in Osaka, Japan when, with a group of editors and dealers, I was able to inspect the facilities of Matsushita Electric in that city and to examine some of their up-and-coming products.

Among those destined for the Australian market was a group of slimline AM/FM-stereo tuners, ranging from an analog model ST-Z25 to the

In a shelf arrangement, there is a good chance that a slim tuner may be able to stand directly under an integrated amplifier or cassette deck, virtually without taking up any extra shelf space.

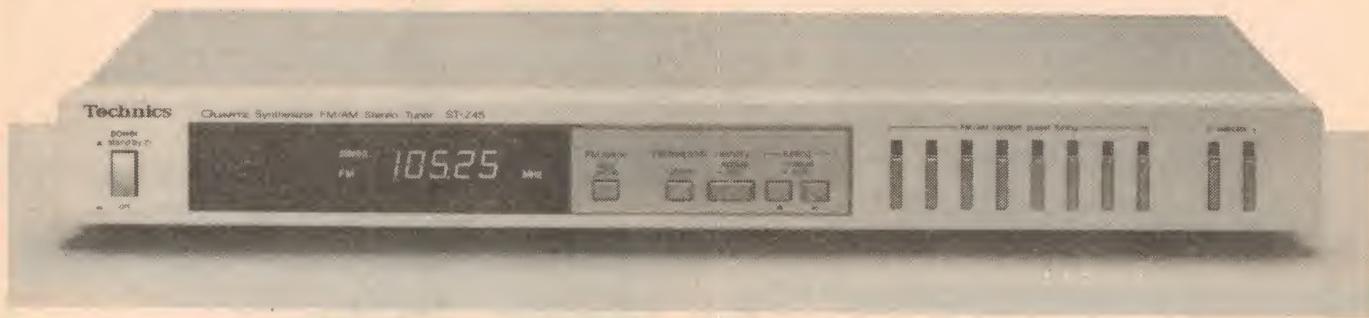
In a hifi rack, the slimmer the components can be the better, if only to leave room for the inevitable "something else".

What of user preference between the

10, and so on down the line. In short, the eight buttons can be used to call up any of 16 channels (ie preset frequencies), AM and/or FM, in any order.

To set up the tuner, it is desirable to have on hand a frequency list of local AM and FM stations, copied from a program guide or from pp 26/27 of our January issue.

With the tuner switched on, the user presses (say) the "FM" button at the right hand end of the panel. This will bring up the letters "FM" and "MHz" in the window and a frequency somewhere in the FM band. This can be stepped either way by pressing "Up" or "Down" buttons on the panel. In Sydney, one might typically start with 2ABC on 92.9MHz. As



quartz/digital ST-S31, with switchable FM bandwidth. But it was the in-between ST-Z45 that caught my eye, especially when Marketing Manager Peter Lee indicated that it would retail in Australia for just over \$200.

Keen to be the first to review the ST-Z45, I did some fast talking and managed to bring back one of the factory prototypes, as pictured. It is identical with the Australian production model except for the mains lead and terminations. These, I was assured, would be rearranged to conform with Australian supply authority requirements.

Physically, the ST-Z45 measures 430(W) x 53(H) x 245(D)mm and weighs a modest 2.4kg. Its power consumption is even more modest, at 8W. It is housed in a silver-grey cabinet with matte finish front panel, touch-button controls and black display window with a fluorescent readout.

The slimline format has much to commend it for those putting together a hifi component system.

tradition analog tuning dial approach and the modern quartz synthesiser, digital readout system, as used in the ST-Z45?

Personally, I must confess to a lingering regard for "do-it-yourself" tuning but the prejudice is becoming increasingly difficult to sustain. With the ready availability of precision crystals and mass-produced special-purpose ICs, it is becoming easier, cheaper and more economical of space to use frequency synthesis than to persist with the gangs, dials and meters required for analog tuning.

And, unlike some "digital" tuners, the ST-Z45 is easy to set up and easy to use – provided the user deigns to take at least a quick look at the instructions!

On the front panel of the tuner is a row of eight soft-touch levers. A single, brief touch on the left-hand lever will cause the letters "CH 1" to appear in the window. Deliberate, sustained pressure, on the other hand, will bring up the letters "CH 9". The adjacent lever to the right can similarly bring up CH 2 to CH

the frequency comes up in the window, the station will be heard.

This can be committed to CH 1 by simply pressing the memory button, followed immediately by a brief touch on the Channel 1 lever. In practice, we found that it needed only a very few minutes to commit seven Sydney FM stations in frequency order to channels 1-7, and eight of the AM stations in order to channels 9-16. That left channel 8 for any other station that might take our fancy in the future.

From there on, tuning a station requires only that the user press the appropriate button in the appropriate manner and up will come the channel number, followed by the exact frequency. There is no need for a tuning meter, as such, or for fine tuning – thanks to the quartz-locked synthesiser.

While it is not possible to manually tune in the usual sense, one can put the tuner into the "scan" mode in which it will step down or up until it comes to the next broadcast. You could do this, for example, if you had a yen to listen to the

sound from television channel 3 or 4. Or you could go searching for weak stations by stepping up or down manually, 50kHz at a time.

If put in the scan mode, the tuner mutes its output normally, so there is no inter-station noise. But if stepped up or down manually, the tuner unmutes at each step, so that if no station is present the output will be white noise.

As mentioned earlier, frequencies can be allocated in any order to the preselect levers, so that the stations can be arranged in any order that takes the user's fancy.

At switch-on, the tuner will come up on the last station to which it was tuned — a handy feature for anyone with fixed listening habits. Better than that, it remembers the last station in each mode, so that favoured stations can be checked by simply hitting the AM and FM buttons.

So much for the ST-Z45, as the user normally sees it. At the rear are connections for an FM antenna using either 75 ohm coax or 300 ohm twin ribbon. (An indoor dipole FM antenna is packed with the tuner.)

As a departure from normal practice, the ST-Z45 does not have an AM ferrite rod, in-built or hinged to the back panel. Instead, a moulded, rectangular air-cored loop is supplied which attaches to terminals at the rear by a short length of twin lead. It is intended to hinge vertically to the rear wall of the cabinet or rack, hopefully clear of mains and loudspeaker wiring, metal panels, and the radiation field from a tape deck.

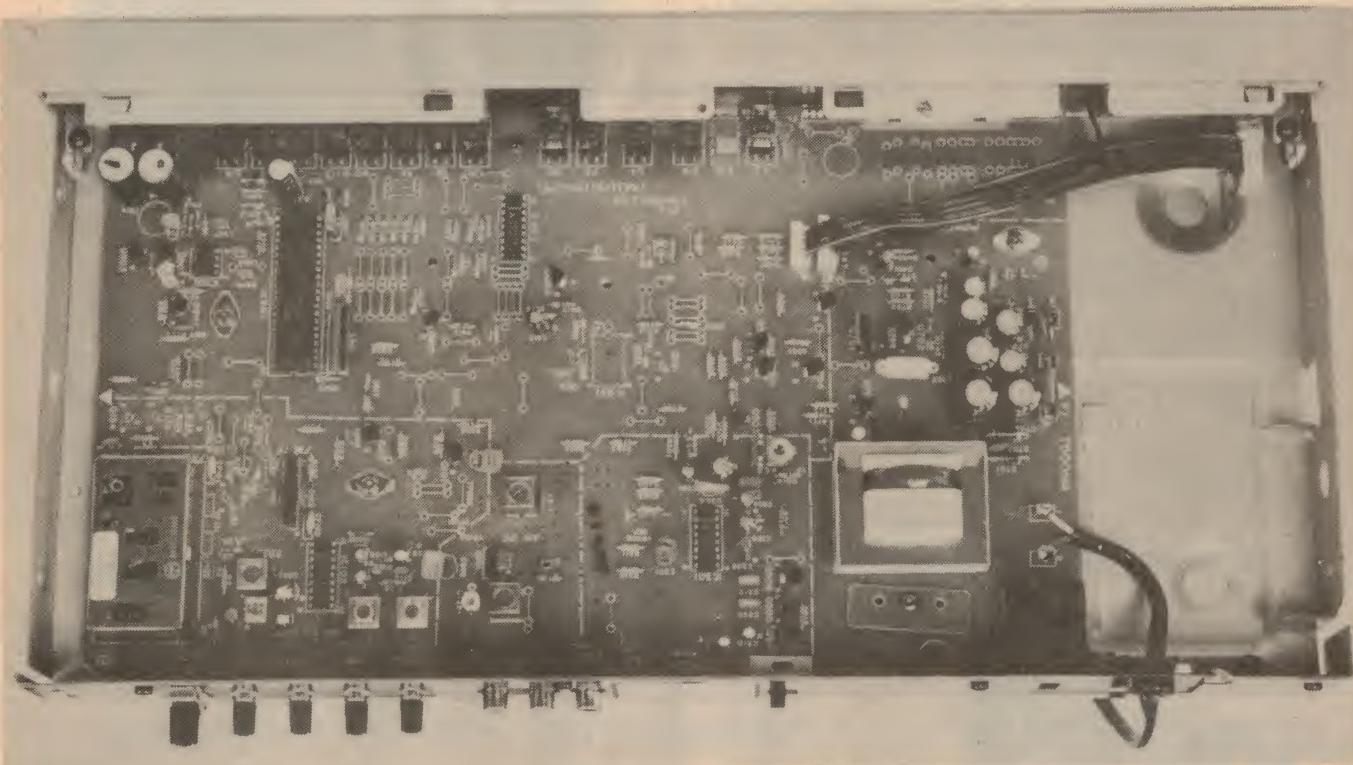
Perhaps a ferrite loop is just too awkward with a slimline tuner but, be that as it may, getting the loop more out in the clear is a step in the right direction.

Also on the rear panel are the audio

performance curves, it is evident that the limiting threshold has been virtually achieved at the lowest measured signal input — $2.0\mu\text{V}$. In mono mode, 50dB of quieting occurs at an input level of $4\mu\text{V}$ and it is at this same level that automatic switchover to stereo mode takes place.

In stereo mode, 50dB of quieting is reached at an input level of $50\mu\text{V}$ — substantially in line with the manufacturer's specs.

The three-step bar-graph display calls for some comment: As will be evident, it saturates at less than $20\mu\text{V}$ which means that, for all practical purposes, almost any signal will cause it to be fully illuminated. As an aid to accurate tuning it would therefore be quite useless — a rather damning statement were it not for one thing: with an accurate quartz-locked synthesiser, tuning should be spot-on, meter or no meter!



The ST-Z45 is quite different from conventional tuners internally. One LSI circuit controls all the synthesiser functions.

Two other points should be made about the memory tuning system. One is that it can be used in automatic rather than manual mode for automatic scanning and memory preset — something that the manufacturers regard as a complete break-through in a \$200 tuner.

The other is that the tuner is equipped with an in-built (and so-called) "gold" capacitor, which can store enough energy to maintain the memory for up to one week if the tuner is disconnected from a live power point. Only under very unusual circumstances would it suffer a lapse of memory!

output sockets for the right and left channels, and a provision for connection to an external timer. There is also a two-way switch which allows the AM synthesiser to step through either 9kHz or 10kHz intervals, depending on the frequency separation of AM stations (in Australia, it is 9kHz).

And how does the ST-Z45 perform?

The answer is "very well" — perhaps not in the ultimate, "no expense spared" class but certainly above average and certainly well beyond what one could have expected in the past from a tuner at this modest price level.

Referring to the measured

But a meaningful signal strength meter is desirable for another reason: it allows the user to see at a glance the strength of incoming signals and to be aware of any circumstances which might prejudice ultimate stereo quieting: 70dB at $1000\mu\text{V}$ of signal.

Harmonic distortion in mono mode was measured at 0.8% at 6kHz, 0.13% at 1kHz, and 0.08% at 100Hz. For stereo the figures were: 0.4% at 6kHz, 0.23% at 1kHz and 0.34% at 100Hz. These figures are very good.

The 19kHz stereo sub-carrier had a measured residual level of -32dB (left channel) and -33dB (right channel),

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Technics ST-Z45 Synthesised AM/FM Tuner

while the figures for the 38kHz switching frequency were -39dB (L) and -41dB (R). The figures are adequate for tape recorders having an in-built multiplex filter but marginal for those which do not.

As for frequency response and channel separation, these are shown in a separate curve. Both are quite adequate for good quality stereo listening.

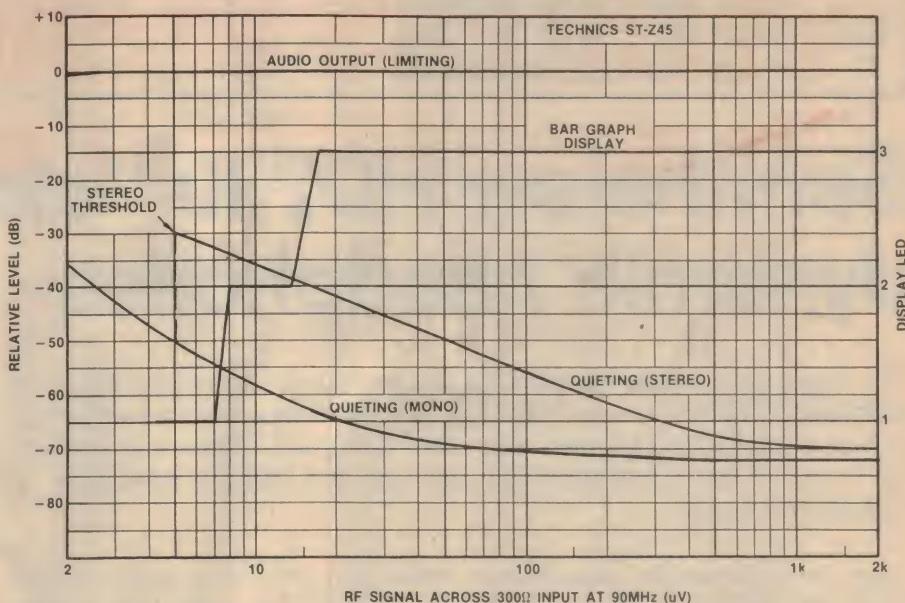
We did not measure the AM-band performance, mainly because there was nothing to indicate that it would have been substantially different from any number of other AM tuners. The specifications read as follows: Sensitivity (S/N 20dB) - 20 μ V or 300 μ V/m; selectivity (± 9 kHz) - 55dB; image rejection at 99kHz - 40dB; IF rejection at 999kHz - 65dB.

Set up in a typical domestic hifi situation, the ST-Z45 looked the part and operated without the slightest hitch.

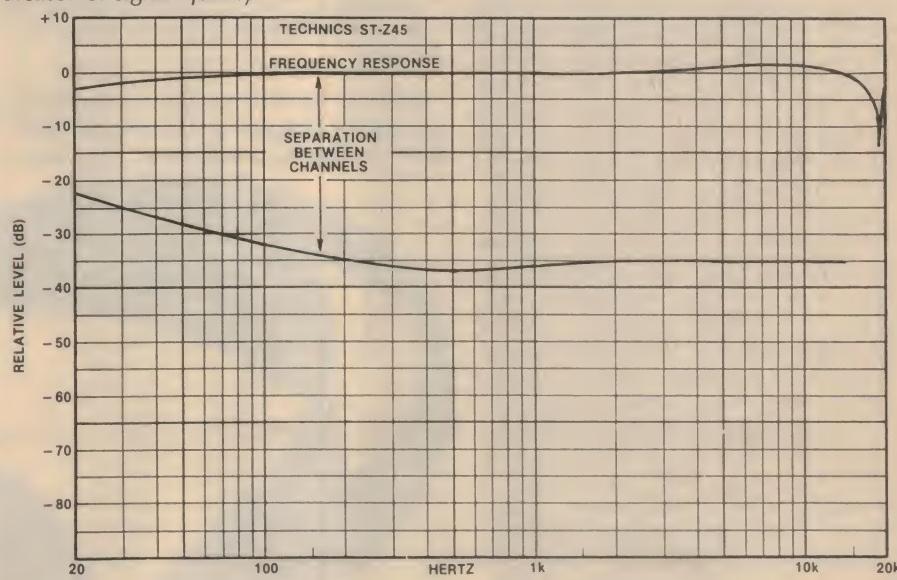
Setting up took only a few minutes and, from there on, station selection proved to be completely fuss-free: press the appropriate button and the wanted signal is there virtually instantaneously (what was all that about do-it-yourself tuning?).

Finally, while the AM tuner received little attention in our review, there was evidence of a bonus from the separate loop antenna: positioned 20cm or so from the equipment and associated wiring, it did appear to pick up a cleaner signal and at night (mercifully) it proved much less sensitive to low level hash from a couple of light dimmers in the living area.

As we said at the outset, with its slimline styling, its specifications and its modest price, the Technical ST-Z45 has the potential to prove a real cat in the hifi pigeon loft! (W.N.W.)



Above is the quieting characteristic of the ST-Z45 which also shows the bar graph signal response. The bar graph really needs a few more steps to be useful as an indicator of signal quality.

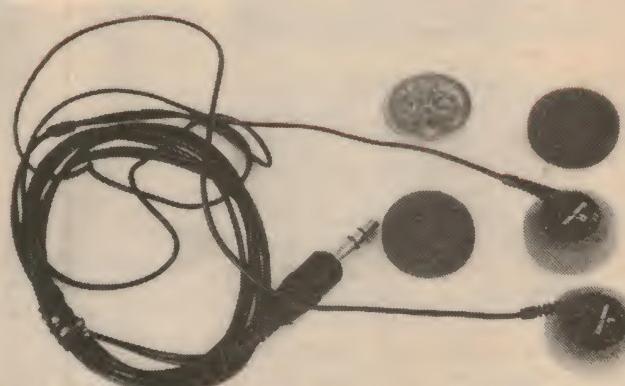


For a really novel and dramatic listening experience, these Sound Track MT-300 Inner Ear Phones just have to be heard to be believed. As the name implies, they fit or rather, sit, in the ear cavity. When they are sitting in just the right position (aimed down with Eustachian tube, as it were) they are capable of surprisingly good wide range reproduction.

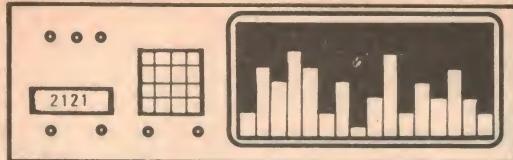
As might be imagined, they are easily dislodged so they are not suitable for joggers or listeners on the move. But they are fine for listening in bed, and are so light (15g) that there is little chance of "ear fatigue". They are thoughtfully provided with an extra pair of foam pads.

The MT-300 ear phones use the new high flux Samarium-Cobalt magnets so their sensitivity is higher than average at 102dB/mW. They have a very light 1.2m cord which is fitted with a 3.5mm stereo jack which is intended for personal portable use. However they may be used with any stereo system if they are first plugged into a 6.5mm stereo adapter plug.

At around \$18 a pair, the Sound Track MT-300 are certainly



worth listening to. They are widely available from electronics and sound retailers, and are distributed in Australia by Arista Electronics Pty Ltd, 39 Jones St, Ultimo, NSW.



HIFI REVIEW

Sennheiser HD230 "closed" dynamic headphones

For some years now Sennheiser has produced a popular range of lightweight dynamic "open-air" headphones. Now, with the introduction of their HD-230 phones, they have changed direction and produced a set of closed headphones but with the claimed advantage of "openaire" sound.

Just why Sennheiser has chosen to go in this new direction is not really clear but they claim that the sound quality is comparable to their highly priced 2002 electret headphones. (We reviewed the forerunner of these, the 2000 phones, in the March 1978 issue). The new HD230 phones have two drivers, one to cover the range up to 10kHz and one to cover the frequencies above that. Sennheiser rate the frequency response as 10Hz to 30Hz, albeit with no amplitude limits.

Certainly the HD230 do look attractive. Their all-plastic construction has appealing styling and is light and comfortable to wear, with an easily adjustable headband and swivelling earpieces. Mass of the phones is a 260g excluding the cord.

The soft ear surrounds conform closely to the wearer's head for good sealing but they are not removable for cleaning or replacement. The fact that they do give a good seal means that the wearer is reasonably well isolated from outside sounds but naturally this does mean that your ears become hot after 30 to 45 minutes or so. This is where all circumaural phones are at a definite disadvantage compared to the supra-aural types. But they generally also give better bass.

Nominal impedance of the HD230 is 600 ohms and they work well into just about any stereo headphone outlet on an amplifier or cassette deck. Efficiency is about average at 94dB/mW and maximum sound pressure level is 117dB for an input power of 200mW. This would require quite a high setting on the amplifier though, to correspond to a voltage level of 11 volts RMS. This means that cassette deck stereo jacks with limited voltage drive will not be able to produce really loud sound levels.

The twin-lead cable fitted with a standard stereo jack plug is a generous three metres in length which lets you move

about freely while listening but you have to be careful not to trip over it. One small problem with the cable is that it seems to transmit rubbing noises as it rubs over the floors or your clothing. A coiled cord normally seems better in this respect.

Without special measuring facilities, judging the frequency response of headphones is largely a subjective affair. Hav-

bass boost did not give a great tonal change although it did cause some muddying of the sound quality when used to excess. Second, hum that is often present on FM transmissions was less noticeable on the HD230s than on some competing phones.

On music, the HD230s are quite satisfying although there is some tendency to emphasis of sibilants and the sound quality was slightly "zizzy" at times.

In summary, we would rank the HD230s as not in the same league as Sennheiser's 2002 electret but if you are in the market for phones in this price range they should be considered.

While the new Sennheiser HD230 phones are quite a deal cheaper than the



ing said that our listening tests on sine wave signals indicated that the HD230s are reasonably smooth over the whole audible range but are not particularly "hot" at either frequency extreme. At the high end, there was certainly no undue emphasis of tape hiss or disc surface noise which is as it should be.

At the low end, bass was not particularly prominent below 100Hz. This can be gauged by two effects. First, use of the

2002 electret phones to which they have been compared, they are certainly not inexpensive. Recommended retail price is \$190, including sales tax.

For further information on Sennheiser products, contact your high fidelity retailer. Trade enquiries should be directed to the Australian distributors, R. H. Cunningham Pty Ltd, 146 Roden St, West Melbourne or 4/8 Waters Rd, Neutral Bay, NSW 2089. (L.D.S.)

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Amazing value! Cat. X-3270

NEW 2M 5/8 WHIP

Whip it good with this amazing new 2 metre VHF antenna! It's a robust flexible antenna that can withstand almost anything! ½ wave means you get an INCREDIBLE 3.5db GAIN!!! Great for any mobile 2M applications. Cat. D-4205

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Sturdy & weatherproof. D-4056 \$4.95

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1 metre 52ohm coax cable with 2 x PL259 plugs. W-1370

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GENERAL PURPOSE UHF ANTENNA

Low cost precision made antenna complete with base & cable connecting lugs. Perfect for mobile UHF CB communication. VALUE!!! Cat. D-4023 Little chance of this antenna rusting, bending or snapping!

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50 top quality single ended electrolytics. Save around \$7! 2.2 - 470uf. Voltages from 10 to 25. Cat. R-7030

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They won't last
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INCREIBLE! A base station CB for under \$80! Talk in the comfort of your own home. This unit features built in power supply (req. 110V stepdown) plus 12V socket, large bright power/signal meter, delta tune, large quality loudspeaker & MORE! Finished in attractive simulated wood grain finish. Rugged design will last for years. Comes complete with easy grip sturdy microphone. VALUE PLUS! Cat. D-1439

SAVE \$90! NOW ONLY
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SEMICONDUCTOR BARGAINS

Hobbyists ...now's the time to stock up on our top quality components. Great for any project. Buy a few more for the parts box too...

Cat. No.	DESCRIPTION	WAS	NOW
Z-6816	MM 5868N	\$9.95	\$7.50
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Z-2390	ZN 5590	\$1.75	99¢
Z-6832	AY 38112	\$8.90	\$4.99
Z-4117	LT 302	\$17.50	\$9.95
Z-9101	ZB 210	\$1.75	\$1.25
Z-1800	MJ 2955		\$8.50
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Plugs 'n' things

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Great for RG58RU cable. Cat. P-2210

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Accepts P-2210

plug

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\$1.95

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Ideal for all audio projects etc.

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\$1.15

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Coloured coded. Spring loaded for instant connection.

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Incredibly useful pack - every serviceman, hobbyist, technician, etc should have a couple! Contains an extremely useful selection of ISO standard nuts, bolts & screws as used in most Japanese gear - the type you're always losing! And look at the low, low price! Cat. H-1680

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DUMMY LOADS (No Irish jokes, please)

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Super high tolerance & high power with virtually no inductance.

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100 watt

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Why Technics their dbx

You can't fit a quart in a pint pot. Dynamic range is what brings music truly 'alive'. It's the difference in sound level between the proverbial 'drop of a pin' and the cannons' roar in a digital recording of the 1812. This difference represents more than 100 decibels of dynamic range – a figure regularly exceeded by a full orchestra or live rock band in full flight.

However, even with modern tape formulations, this full dynamic range cannot be captured on a cassette recording due to the inherent limitations of the tape itself. The quietest passages become submerged in tape hiss, whilst the louder parts suffer distortion through tape saturation.

Clearly, the capabilities of the cassette tape have been stretched to their limits. How, then, can further performance increases be achieved?

Technics proves 2 into 1 does go!

The new generation of Technics cassette decks are equipped with dbx encoding/decoding equipment – a system already well established in professional recording studios.

When a recording is made through the Technics dbx system, the input signal is compressed (encoded) to half its 'sound level', electronically,



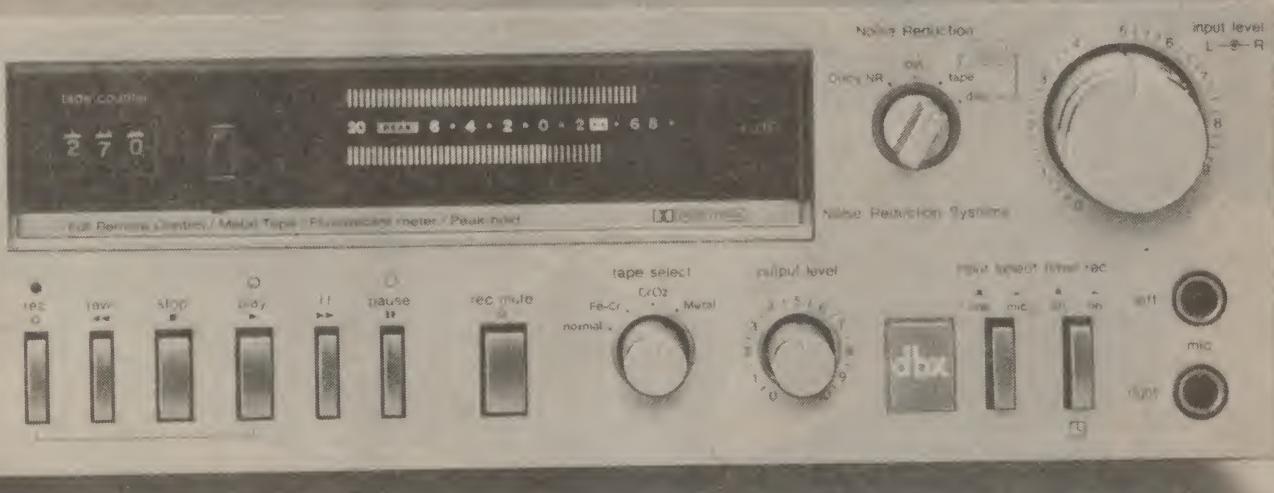
so a performance with a wide dynamic range can be stored within the narrower dynamic capabilities of a cassette.

On playback, a 'mirror image' expansion (decoding) takes place and the original full dynamic range is released. The results are dramatic. Simply compare the performance of a Technics dbx deck with an ordinary machine and the difference will stagger you.

And, as an interesting by-product of the process, your recordings will benefit from around 30 decibels of noise reduction, too.

With Technics, you're ready for dbx recordings, too. In hi-fi terms,

have developed cassette decks.



the quality of pre-recorded cassettes has left much to be desired. But when dbx recorded material is released in Australia, you'll notice a big difference. Play a pre-recorded dbx tape through your Technics dbx cassette deck and you may well think you're listening to a good quality disc.

And whilst on the subject of discs, there are dbx albums being made, too. Naturally, Technics have taken this into consideration. And you'll find a DISC position on the dbx selector, so you can play dbx-encoded albums through your existing system.

Technics RS-M270X dbx cassette deck. A typically advanced Technics component that combines

stable, reliable tape transport with highly sophisticated electronics. Direct drive motors for both capstan and reel drive; IC logic solenoid controls; 2-colour, peak-hold FL meters; 20-20,000hz frequency response with metal tape; 110 dbs dynamic range.

Let Technics expand your music experience to new horizons.

Listen to a Technics dbx cassette deck and hear the amazing difference for yourself.

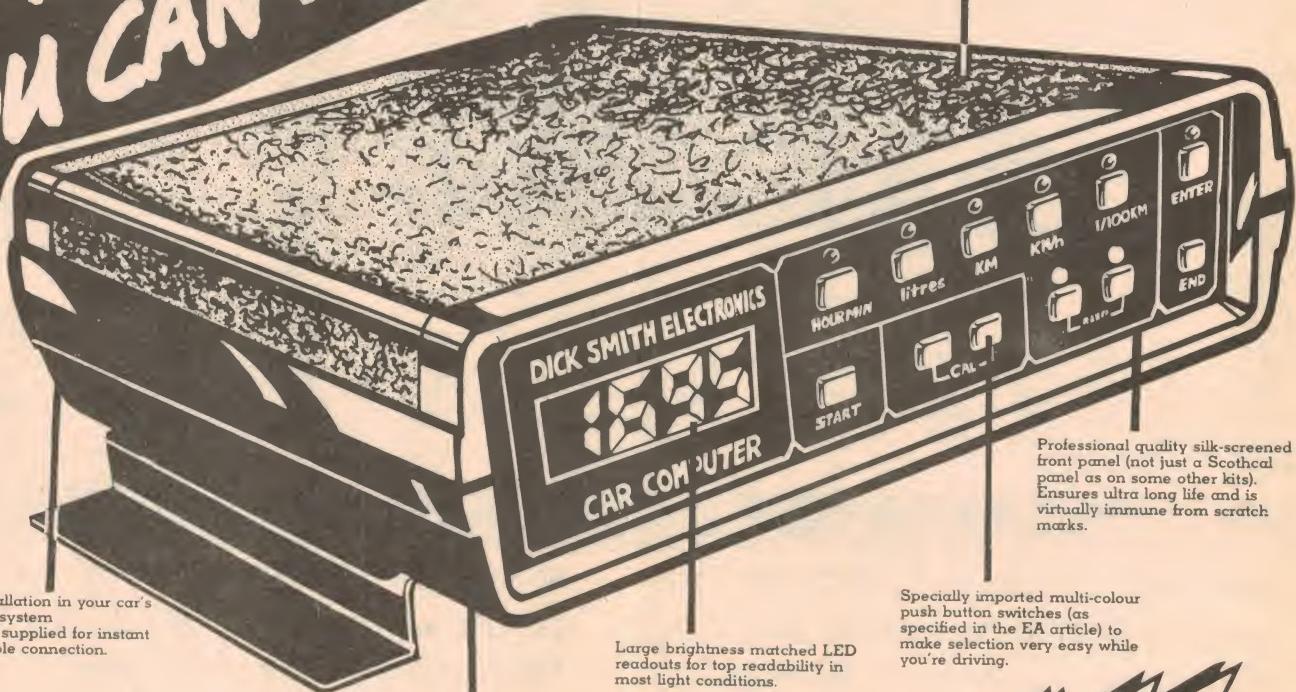
Of course, all Technics components carry a two-year warranty.

Technics
Expanding the music experience.

AT LAST! THE E.A. CAR COMPUTER— YOU CAN SAVE A FORTUNE!



Our kit comes complete with specially designed case INCLUDED IN THE PRICE (don't pay \$30 extra!) Also included at no extra charge is a special mounting bracket to mount the computer either on or under the dashboard.



Easy installation in your car's electrical system
PCB pins supplied for instant and reliable connection.

YES! The kit you've been waiting for is now a reality. Electronics Australia's new Car Computer is the ideal way to find out how your car is performing — and how much it is costing you to run it!

Now you'll be able to check fuel consumption — instantly — and find out exactly how much damage a lead foot does to your pocket.

All those questions you ask yourself as you're driving along can be answered — electronically — in a fraction of a second ...

- How much fuel is left?
- Can I make it to the next town?
- How far have I travelled?
- How long has it taken?
- How long have I got to go this trip?
- How far have I got to go?
- How much fuel have I used/am I using/will I use?
- What's my exact speed (much more accurate than the speedo)?

Inside: Two computer-grade double sided fibreglass printed circuit boards with plated-through holes for minimum soldering. Don't be caught with a PCB without plated-through holes: you'll regret it when you start construction!

Amazing technology: how is it done?

A few years ago a device such as this would have been virtually impossible to build — especially build yourself.



Dick Smith searched the world for the most important components — the fuel and speed sensors — and the brilliant design engineers at Electronics Australia did the rest! The result: a magnificent kit which really can save you a lot of money! Simply because it can show you how to drive really economically.

Professional quality silk-screened front panel (not just a Scotch panel as on some other kits). Ensures ultra long life and is virtually immune from scratch marks.

Specially imported multi-colour push button switches (as specified in the EA article) to make selection very easy while you're driving.

OUR KIT ONLY \$89⁵⁰
sensors extra
Cat K-3400

Special Computer Quality PC Board

Yes: we've not only made our board with plated through holes (as recommended by EA) we've also had a solder mask and component position overlay printed. You'll find it difficult to make an error!

Low Noise IC

We've arranged a special purchase of low-noise Schmitt trigger IC's (as used in the front end). Your Dick Smith car computer will be less prone to noise problems than other kits!

It will give you 12 different readings:

TIME

Either the time elapsed since the start of the journey (accurate to one minute) or the time remaining to complete the journey at your average speed since commencement (updated every minute or kilometre travelled).

1.25
15.20
10.38
94.03
8.55

FUEL

It will show you the amount of fuel you have used — or the amount of fuel you have left — or even how much fuel your tank can take at the moment!

DISTANCE

Your choice of distance travelled, or the distance remaining on this journey — or the distance possible with the amount of fuel you have left.

SPEED

Your exact present speed (much more accurately than your speedo can show!) or your average speed since the start of the journey.

CONSUMPTION

Either your present (instantaneous) consumption (lead footers: be prepared to be shocked!) or your average consumption since the start of your journey.

**AND EVEN MORE REASONS
WHY YOU SHOULD BUY YOUR
KIT FROM DICK SMITH
ELECTRONICS!**

Exclusive!

Our special 7 day money-back satisfaction guarantee: buy the kit, examine it — and if you're not completely happy with it or not confident you can build it (it's easy!) you can return it within 7 days for a full refund of purchase price. What can you lose?



Exclusive!

Our unique 'Sorry Dick, it doesn't work' repair service. In the unlikely event that you can't get your kit working successfully, our Service Department will, for a fixed fee, repair, adjust your kit* as necessary to get it working properly. This fee includes all parts necessary.

*Sorry Dick, it doesn't work' service available on specifically nominated kits; and we reserve the right to return your kit, with your service fee, should it be so badly wired or damaged as to make repair uneconomic.



Exclusive!

Our unique construction manual. We have a technical writer prepare a special step-by-step construction manual for most of our kits — so you don't have any problems. Everything is clearly and logically presented, with all construction information from the magazine — plus any other traps for young players we discover along the way. We discover any problems before they affect you!

EXCLUSIVE!!!

SOLE
AUTHORISED
AUSTRALIAN AGENTS
FOR THE FAMOUS

**MORAY
FUEL FLOW
SENSOR**

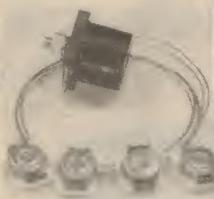


Cat. K 6100

(The one recommended by Electronics Australia) Don't be fooled — the ONLY fuel flow sensor to give optimum results with the car computer is the fully imported 'Moray' unit. And Dick Smith Electronics are the sole authorised Australian agents for this magnificent device. It delivers an incredible 1500 pulses per 0.1 litres (other kits may be supplied with inferior sensors delivering only 130 pulses/0.1 litres). So with the 'Moray' sensor you get incredibly increased accuracy.

\$67⁵⁰

**DRIVELINE
SPEED
SENSOR**



More accuracy — Easier installation
Knowing how incredibly difficult it can be to cut successfully a speedometer cable without risk of damage, we've decided to use the alternative (and, we think, much better) driveline sensor. A lot easier to install, it is not subject to the problems of speedo cables. And a further BIG advantage: when your speedo cable breaks (as they ALL do eventually) you'll still have a very accurate speedometer. (Not possible if you use the other sensor).

Cat. K-6102

\$7⁵⁰

SPECIAL OFFER: Buy both sensors and get the speed sensor for only \$2.00!
YES: The exclusive Moray Fuel Flow Sensor plus the Driveline Sensor at the bargain price of just \$69.95! This makes the complete Dick Smith Car Computer only \$159.45 — with nothing else to buy!

DICK'S PRICE
\$159⁴⁵

**REMOTE DISPLAY
OPTION**

A number of customers have told us they'd love to own a car computer but that the project was simply too big to put on their dashboard. So we've solved that little problem.

This is the exclusive Dick Smith Electronics car computer remote display option. It simply connects in parallel to the existing displays in the main computer (these can be disabled if you like) and also with five of the push buttons (you select the readings you want the most). And all it measures is a tiny 110 x 70 x 50mm — complete with its own mounting bracket.

Included are the four LED displays, five push buttons and the PCB's, plus enough rainbow cable to connect it all together. If you really want to have all functions displayed, there's plenty of room on the front panel to add at least another four small push buttons. Complete with full instructions — and remember, it's not available anywhere else!

NOTE: This important option is only available from Dick Smith Electronics



Cat. K-3405

\$19⁹⁵

DICK SMITH Electronics

SEE PAGE 98 FOR ADDRESS DETAILS

DSE/A312/LM



Simple circuit gives pseudo stereo sound

Stereo synthesiser for tuners & VCRs

Enjoy the benefits of stereo sound from your video cassette recorder, TV or AM tuner with this Stereo Synthesiser. The circuit uses just four ICs and is easy to build.

By JEFF SKEEN and GREG SWAIN

Anyone who has ever directly compared mono to stereo sound will be well aware of the advantages of stereo reproduction. Stereo imparts a sense of dimension and realism to reproduced sound, thus providing greater listening pleasure. Now, with this simple device, you can synthesise realistic stereo sound from virtually any monophonic source, including VCRs, TV sets and AM radios.

In use, the Stereo Synthesiser is simply connected between the monophonic signal source and your stereo amplifier. Front panel toggle switches then let you choose between two signal sources, and between normal and synthesised stereo sound.

Synthesised stereo

Stereo reproduction relies on amplitude and phase differences between the two channels of a stereo system. To synthesise stereo from a monophonic signal, therefore, we need to have some means of artificially

recreating these amplitude and phase differences. In practice, this involves dividing the mono signal into several components, and then distributing these components between the left and right channels.

So how is this done?

One technique involves passing the mono signal through a number of bandpass filters, and then mixing the outputs back with the original signal in the left and right channels. The frequencies passed by the bandpass filter increase in volume in the channel to which they are added and decrease in volume in the channel from which they are subtracted. By alternately adding to one channel and subtracting from the other, we can synthesise quite acceptable stereo sound.

In fact, this technique has been used by the recording industry for many years to process old monophonic recordings into simulated stereo records.

The synthesiser described here uses an

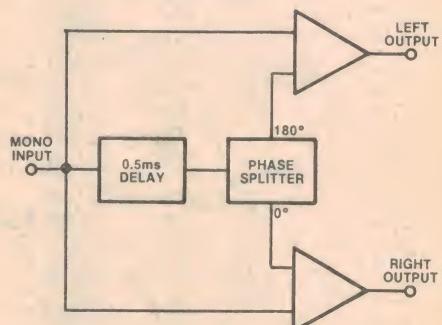


Fig. 1

even more effective, yet much simpler, add and subtract method to create stereo sound. It uses a comb filter technique, a term which we will explain further.

If a signal is delayed and then mixed back with the original signal, the frequency response of the system ends up as a series of peaks and troughs. This is because in-phase signals are added, while out-of-phase signals are subtracted. If there are enough peaks and troughs, the frequency response will resemble the teeth of a comb — hence the term "comb filter".

In this circuit, the delay for the comb filter effect is generated by a bucket



Front panel switches let you choose between normal and synthesised stereo sound, and between two different monophonic signal sources. Unit is housed in a standard metal case.

brigade device (BBD). The delay time is set to approximately 0.5ms, and this has the effect of evenly dividing the audio spectrum into 1kHz "chunks" — about optimum for effective stereo simulation.

How it works

Block diagram Fig. 1 shows the general circuit concept. The input signal is fed direct to the 0.5ms delay line which in turn drives a phase splitter network. The 0° and 180° phase-shifted (and delayed) outputs are then fed to left and right channel mixer circuits, where they are mixed with the original mono signal.

At very low frequencies, the 0.5ms delay time is short relative to wavelength. Thus, the delayed signal reinforces the signal in the right channel and tends to cancel the signal in the left. As a result, low bass is 6dB louder in the right channel, and almost totally absent in the left. At 1kHz, however, a 0.5ms delay represents one-half of the wavelength, so the two phases are effectively reversed. We now get a 6dB reinforcement in the left channel and signal cancellation in the right.

This addition and subtraction effect is repeated for each 1kHz interval (actually slightly less in the prototype) across the audio spectrum, with maxima and minima occurring at each 1kHz "marker". This is depicted in Fig. 2 which plots the frequency response of the two output channels. Note that when the output on one channel is at a maximum, the other channel is at a minimum.

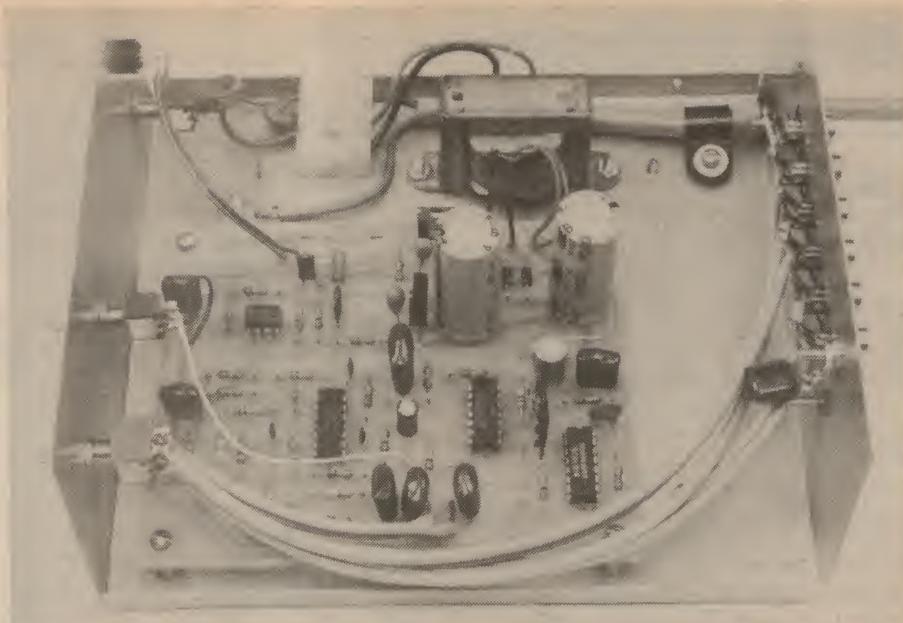
Circuit description

The circuit is based on a design that appeared in the June 1982 edition of the American magazine "Popular Electronics". However, while our circuit uses the same general principle, it has been extensively modified to improve the performance and make use of locally available components.

Input signals to the stereo synthesiser are fed in via two pairs of RCA input sockets. One pair of input sockets is wired in parallel and accept a mono input signal, eg from a VCR or a TV set. The other pair are isolated from each other and can accept either a stereo input signal — as from an FM tuner — or a paralleled mono input signal.

Switch S1a,b selects between the two source inputs and passes each channel through a subsonic filter formed by a $0.1\mu F$ capacitor and two $47k\Omega$ (or $1 \times 100k\Omega$) resistors. The left input signal is then fed to the input of mixer/buffer amplifier IC1a, while the right input signal goes to IC1c. IC1a and IC1c both function as inverting amplifiers with gain set to unity by $100k\Omega$ feedback resistors.

A $56pF$ capacitor is included in the feedback loop of each amplifier to roll off the response above 30kHz. This is a



A single printed circuit board accommodates most of the components. Keep mains wiring neat and tidy to avoid the possibility of electric shock.

PARTS LIST

1 metal case, 160 x 184 x 70mm
 1 Scotchcal front panel, 160 x 75mm
 1 printed circuit board, code
 82/ms/8, 121 x 99mm
 1 six-way RCA socket panel
 2 SPDT toggle switches
 1 DPDT toggle switch
 1 28V, or 36V CT transformer,
 Ferguson PF3786, PF3787 or
 equivalent
 1 mains cord and plug
 1 mains cord clamp
 1 three-way terminal block
 1 rubber grommet
 2 solder lugs
 4 12mm tapped brass standoffs

CAPACITORS
 2 1000 μF /25VW PC electrolytic
 1 47 μF /16VW PC electrolytic
 2 10 μF /16VW tantalum
 1 10 μF /16VW PC electrolytic
 1 0.22 μF metallised polyester
 (greencap)
 7 0.1 μF greencap
 1 .0015 μF greencap
 1 .0012 μF greencap

1 470pF 2kV disc ceramic
 1 150pF disc ceramic
 1 120pF disc ceramic
 4 56pF disc ceramic

SEMICONDUCTORS
 1 LF347 quad BiFET op amp
 1 MN3001 dual n-channel BBD
 1 4049 hex inverter
 1 TL071, LF351, Fet-input op amp
 1 7815 +15V 3-terminal regulator
 1 7915 -15V 3-terminal regulator
 1 4.7V 400mW zener diode
 4 1N4001 1A silicon diodes
 2 1N4148 silicon diodes
 1 red LED and bezel

RESISTORS ($\frac{1}{4}W$, 5% unless stated)
 3 x $120k\Omega$, 8 x $100k\Omega$, 2 x $47k\Omega$, 3 x
 $27k\Omega$, 1 x $22k\Omega$, 5 x $10k\Omega$, 1 x $5.6k\Omega$, 1
x $2.7k\Omega$ $\frac{1}{2}W$, 1 x $1.5k\Omega$, 1 x $1k\Omega$, 2 x
 390Ω , 1 x $10k\Omega$ large vertical trimpot.

MISCELLANEOUS

Machine screws and nuts, 1 metre of
shielded audio cable, 200mm of rainbow
cable, solder, etc.

precautionary measure, designed to filter out any noise from the bucket brigade device when the unit is operating in the synthesiser mode.

Delay line driver IC1b functions as a non-inverting unity gain buffer stage. Its input signal is derived from the left channel, at the junction of the two $47k\Omega$ input resistors, and will be half the amplitude of the original signal due to the voltage

divider action of these resistors. Since IC1b has unity gain, its output is also one half the left input signal, and this ensures that signal peaks within the delay line are well below maximum.

The output from the delay-line driver passes to the pin 3 input of IC2, an MN3001 dual 512-stage bucket brigade device that operates as an analog shift register. Input bias voltage from the BBD

is set by trimpot VR1, and this is blocked from the output of IC1b by a $10\mu F$ capacitor. Switch S2 bypasses the stereo synthesiser function by grounding the output of IC1b, thereby removing by signal from the delay line.

We won't delve into the internal operation of the BBD here. Suffice to say that if an audio signal is fed to its input, a delayed version of this signal appears at the output. Note that in this circuit only one-half of the MN3001 BBD is used. The unused pins of the other half are tied either high or low.

Clock signals for the BBD are derived from a two-phase clock oscillator formed by IC3, a 4049 hex inverter IC. IC3a, 3b and 3c form a standard CMOS oscillator, while inverters IC3d and IC3e buffer the out-of-phase clock signals to pins 2 and 12 of IC2. The nominal clock frequency is 550kHz.

The delay time through IC2 is $465\mu s$ (512 divided by twice the clock frequency). Its output signal appears at pins 13 and 14 and is AC-coupled to a low pass filter which uses a single Fet-input op amp (IC4) and three RC networks.

This combination active/passive filter gives a Butterworth response (maximally flat in the passband) and a -3dB point at 20kHz. Gain in the passband is unity, while the ultimate slope of the filter is 18dB/octave above the corner frequency (-3dB point).

IC4 and IC1d effectively operate to produce two buffered outputs, one 180° out of phase with the other. In other words, we have the phase splitter referred to in Fig. 1. The in-phase delayed signal appears at the output of IC1d and is fed into the right channel mixer amplifier (IC1c) via a $27k\Omega$ resistor. The out-of-phase delayed signal appears at the output of IC4 and is fed into the left channel mixer amplifier (IC1a), again via a $27k\Omega$ resistor.

Thus, when the delayed signal is exactly in phase with the original, the output from the right channel increases by about 6dB and the left channel output decreases to about -20dB (or less). This situation is reversed when the delayed signal is exactly out of phase with the original.

The power supply is conventional and consists of a 30V centre-tapped transformer driving a bridge rectifier, with filtering provided by two $1000\mu F$ 25VW electrolytic capacitors. Regulated $\pm 15V$ supplies are derived using positive and negative 3-terminal regulators, while zener diode D3 provides the +4.7V rail. The remaining -13.8V rail is derived using diodes D1 and D2.

Decoupling of the regulator outputs is provided by two $10\mu F$ tantalum

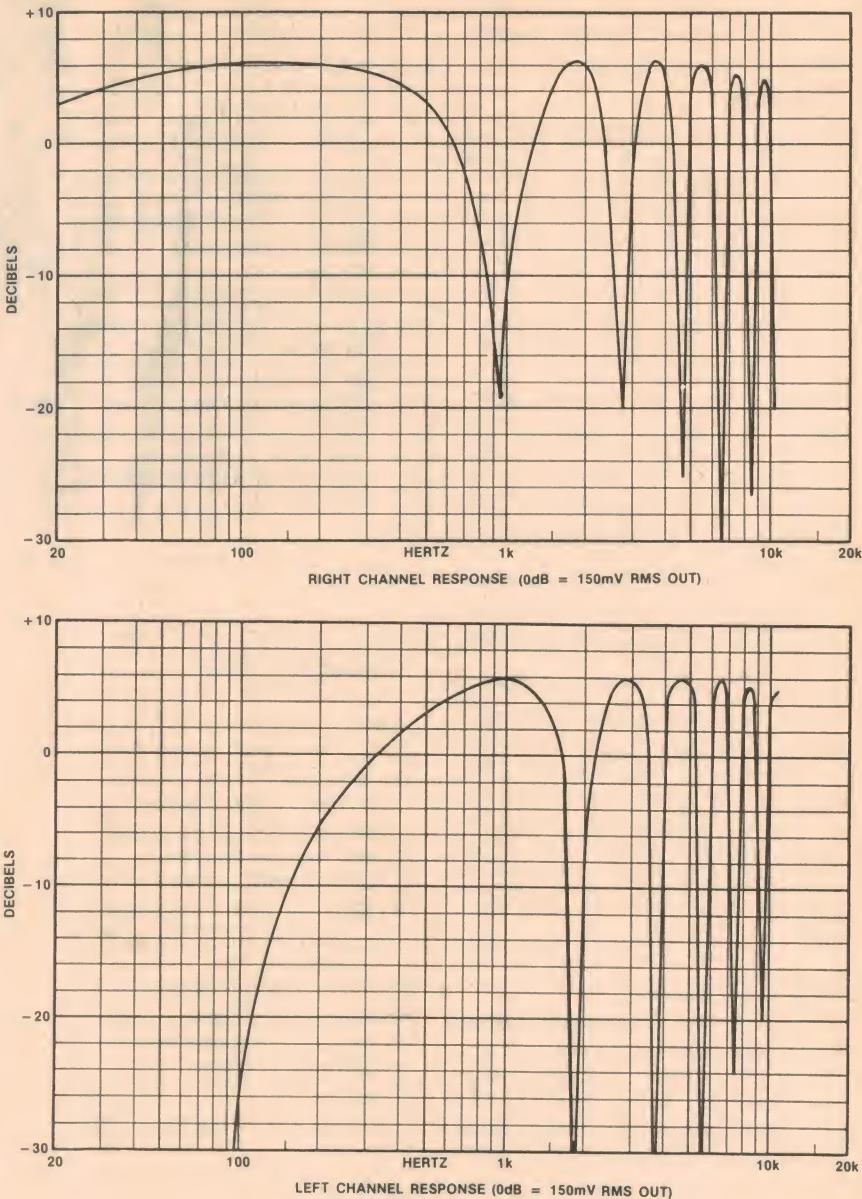


Fig. 2: frequency response curves for the right and left output channels. Note that when one channel is at maximum output, the other is at minimum.

capacitors, while a LED connected in series with a $2.7k\Omega$ resistor across the $\pm 15V$ rails provides power on/off indication. The $470pF$ capacitor across the mains switch (S3) is included to minimise switch-on transients.

Readers should also note the $0.1\mu F$ capacitor between the circuit earth and chassis. This capacitor AC-couples the 0V rail to chassis to suppress mains-borne interference, while at the same time avoiding the hum loop problem that a direct connection would cause.

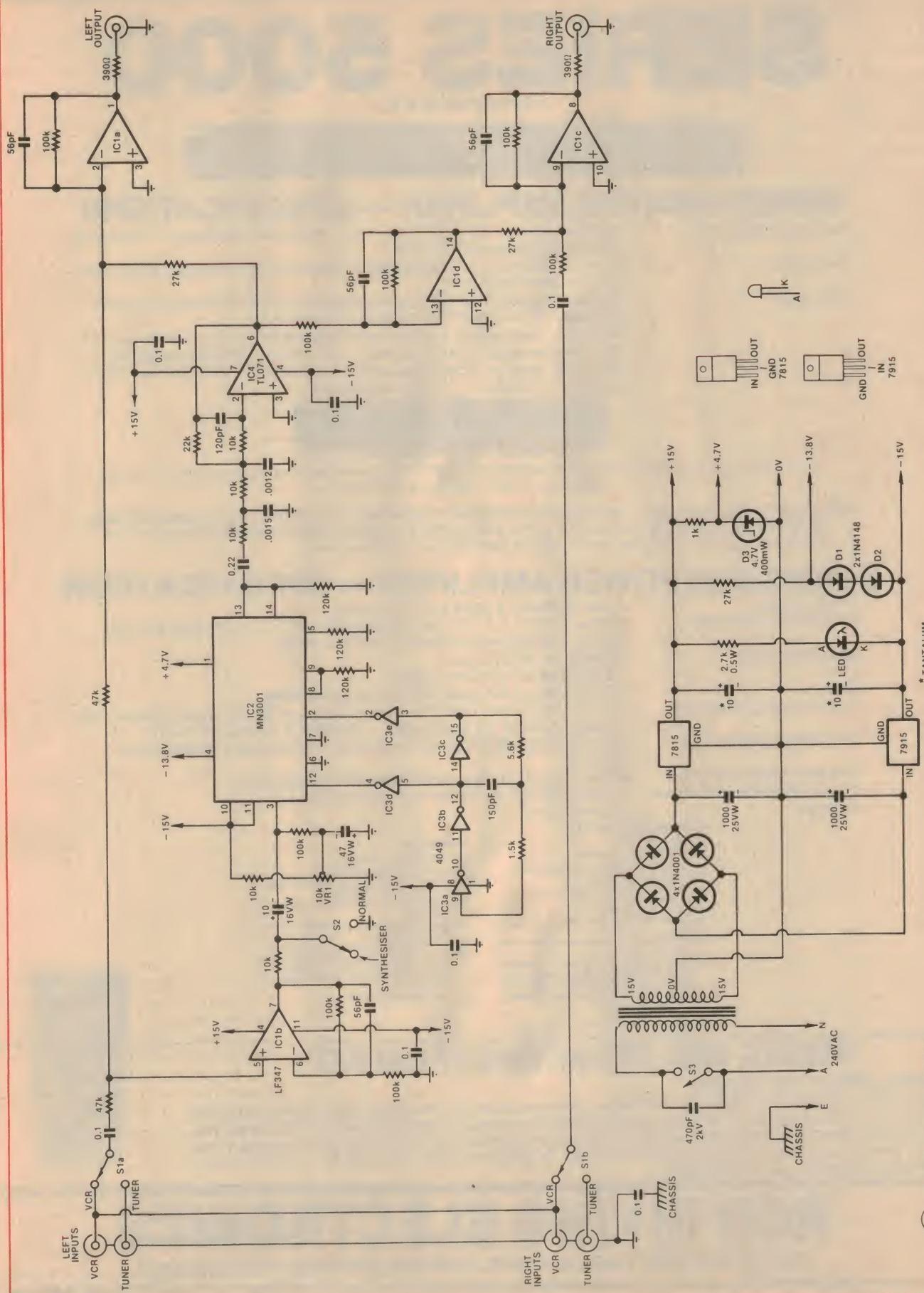
Construction

The circuit is built on a small printed circuit board (PCB) coded 82ms8 and measuring $121 \times 99mm$. Assemble the PCB according to the parts layout

diagram, leaving the four ICs until last. Pay particular attention to the orientation of polarised components and don't forget the four wire links.

The MN3001 and 4049 ICs are both CMOS devices, so the usual precautions should be observed. Earth the barrel of your soldering iron to the earth track on the PCB using a small clip lead and solder the power supply pins first. These are pins 1, 4 and 11 for the MN3001, and

A two-phase clock (IC3) driving a bucket brigade device (IC2) forms the heart of the circuit. The delayed signal from the BBD is fed to phase splitter IC4/IC1d and the resulting signal mixed back with the original.



EA STEREO SYNTHESISER

SERIES 5000

As designed by ETI



SERIES 5000 PREAMPLIFIER — SPECIFICATIONS

Frequency response:	High-level input: 15Hz-130 kHz, +0, -1 db Low-level input — conforms to RIAA equalisation, ± 0.2 dB
Distortion:	1kHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
S/N noise:	High-level input, master full, with respect to 300 mV input signal at full output (1.2V): >92 dB flat >100 dB A-weighted. MM input, master full, with respect to full output (1.2V) at 5 mV input, 50 ohm source resistance connected: >86 dB flat >92 dB A-weighted. MC input, master full, with respect to full output (1.2V) and 200 μ V input signal: >71 dB flat >75 dB A-weighted.



N.B. Picture is only of original heatsink supplied with this project. Our one is tapped from the rear so that no screw heads are visible. New picture next month.

Please note that the "Superb quality" Heatsink for the power amp was designed and developed by Rod Irving Electronics and is being supplied to other kit suppliers. This product cost \$1,200 to develop so that your amplifier kit would have a professional finish as well as sound. We also have a new range of rack mounting boxes which will be released soon.

SERIES 5000 POWER AMPLIFIER — SPECIFICATIONS

Power output:	100W RMS into 8 ohms (± 55 V supply).
Frequency response:	8 Hz to 20 kHz, +0—0.4 dB 2.8-Hz to 65 kHz, +0—3 dB. NOTE: These figures are determined solely by passive filters.
input sensitivity:	1V RMS for 100W output.
Hum:	—100dB below full output (flat).
Noise:	—116 dB below full output (flat, 20 kHz bandwidth).
2nd harmonic distortion:	<0.001% at 1 kHz (0.0007% on prototypes) at 100 W output using a ± 55 V supply rated at 4 A continuous. <0.003% at 10 kHz and 100 W.
3rd harmonic distortion:	<0.0003% for all frequencies less than 10 kHz and all powers below clipping.
Total harmonic distortion:	Determined by 2nd harmonic distortion (see above).
Intermodulation distortion:	<0.003% at 100 W. (50 Hz and 7 kHz mixed 4:1).
Stability:	Unconditional

EXTRA FEATURES OF OUR KITS POWER AMPLIFIER

- KIT PRICE \$279.00 P & P \$8.00
- 1% Metal Film Resistors are used where possible
 - Prewound Coils are supplied
 - Aluminium case as per the original article
 - All components are top quality
 - Over 200 Kits now sold
 - We have built this unit and so know what needs to go into every kit
 - SUPER FINISH Front panel supplied with every kit at no extra cost to you
 - We are so confident of this kit that we can now offer it assembled and tested so that people who do not have the time can appreciate the sound that this amplifier puts out. This is done on a per order basis delivery approx. two weeks after placement.

The price is only \$399.00

*All parts available separately for both kits.

PREAMPLIFIER

KIT PRICE \$239.00 P & P \$8.00

- 1% Metal Film Resistors are supplied
- 14 metres of Low Capacitance Shielded are supplied (a bit extra in case of mistakes)
- English "Lorlin" Switches are supplied no substitutes as others supply
- We have built and tested this unit and so know what needs to go into every kit
- Specially imported black anodised aluminium knobs
- Again as with the power amp we are offering this A & T at a price which we do not believe there is a commercial unit available that sounds as good. Same delivery as the P.A.

All the above for only \$399.00

SERIES 4000 SPEAKERS FROM ETI

SERIES 4000/14-WAY SPEAKERS

A no compromise, top-line system designed by David Tilbrook and described in the February 1980 ETI. Those who own them or have heard them universally praise them for clarity of sound, superb stereo imaging and smoothness of response. Employing Philips' latest range of low distortion drivers and a specially-designed crossover network (another Tilbrook masterpiece) these speakers are the equal of other systems costing up to three times the price. The 4000/1 will handle 100 W continuous, up to 400 W peak. PLEASE CHECK PRICES AND AVAILABILITY



ROD IRVING ELECTRONICS

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pins 1 and 8 for the 4049. No special precautions are required for the LF347 and TL071 devices, but you should make sure that all ICs are inserted the right way round.

A standard metal case 160 x 184 x 70mm (W x D x H) is used to house the PCB. Using the photographs as a guide, mount the six-way RCA socket panel and drill mounting holes for the PCB, mains transformer, terminal block, cord clamp and earth solder lug. The mains cord entry hole should also be drilled at this stage, and fitted with a rubber grommet.

Next, spray the Scotchcal front panel with a hard-setting lacquer (eg, "Estapol") to prevent scratches and carefully affix it to the front panel. Install the front panel switches and LED and mount the various hardware items in the case. The internal wiring can now be completed according to the diagram.

Pass the mains cord through the grommeted entry hole and anchor it securely with the cord clamp. The active (brown) and neutral (blue) leads are connected to

We estimate that the current cost of components for this project is approximately

\$55

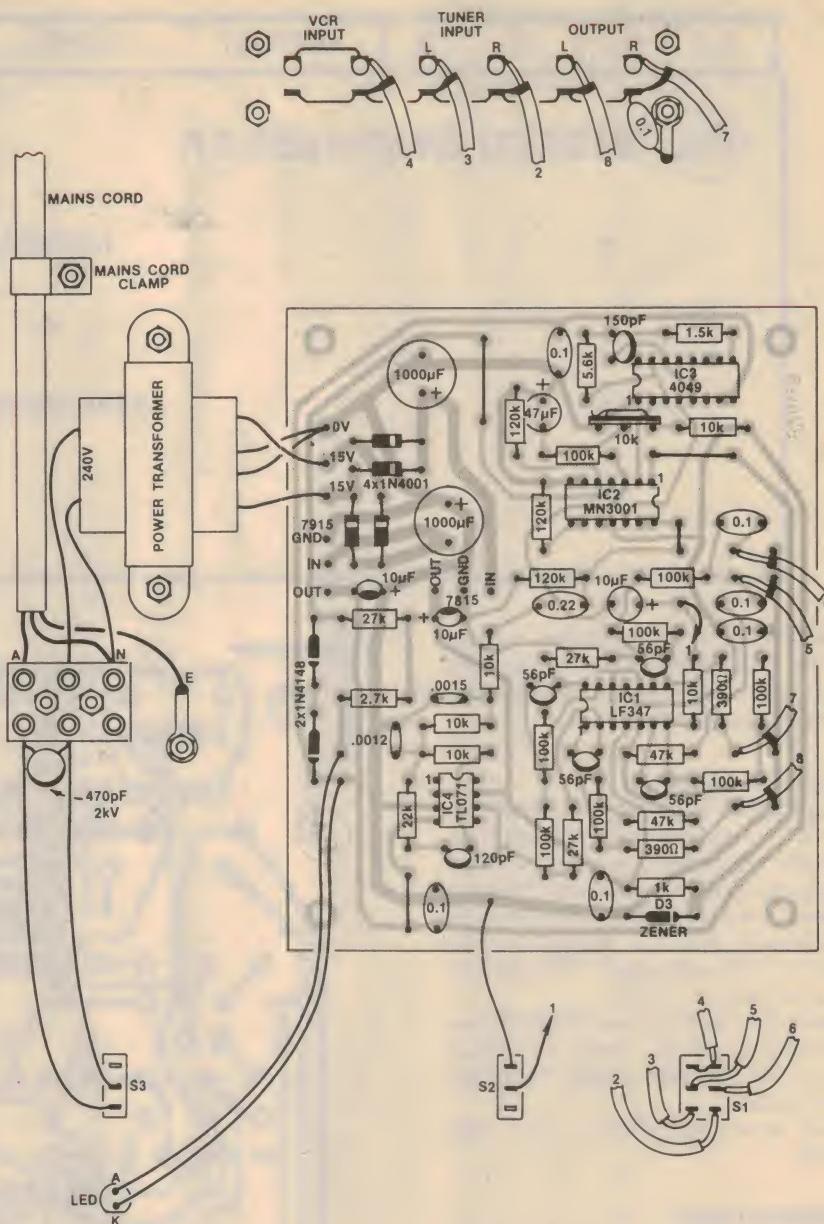
This includes sales tax.

the insulated terminal block, while the earth lead (green/yellow) goes to a solder lug bolted to the chassis. Complete the mains wiring to switch S3 and the transformer primary using 250VAC rated hook-up wire.

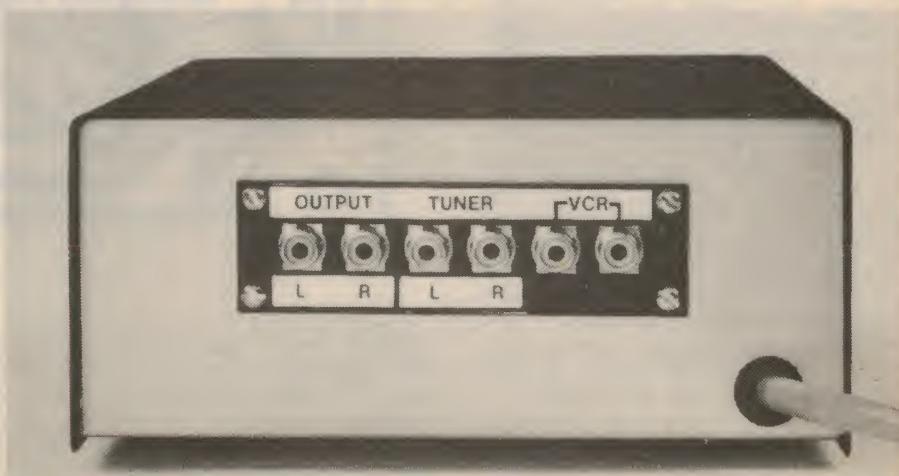
The 470pF 2kV mains suppression capacitor is connected directly to the terminal block. Keep the leads to this capacitor reasonably short to prevent them from contacting the chassis (or the user).

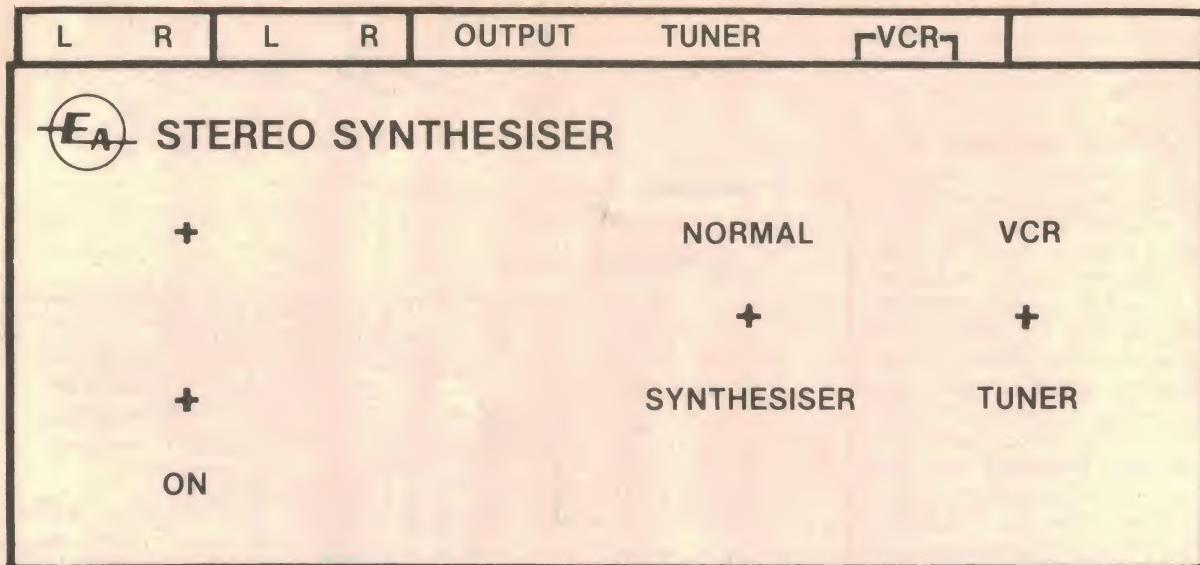
Connections to the LED and switch S2 can be run in rainbow cable, but you must use shielded audio cable for all connections to the RCA sockets. Don't forget the 0.1 μ F capacitor between the circuit earth and chassis, and note the wire link between the active terminals on the VCR input sockets. Do not make a direct connection between the circuit earth and chassis.

The PCB can now be mounted in position using 12mm brass standoffs and machine screws and washers. Check your work carefully before switching on – a few minutes checking here can save you a lot of hassles later on if you've made some silly wiring error like inser-



Make sure that polarised components are correctly oriented and note the 0.1 μ F capacitor between the circuit earth and chassis. Below is the rear panel.





Above and right are actual size artworks for the front panel and PCB. Finished boards and panels will be available from the usual retail outlets.

ting an IC back-to-front.

Satisfied that all is correct, rotate trim-pot VR1 to mid-position and switch on. The only adjustment necessary involves setting the bias on pin 3 of the BBD (IC2). Connect your multimeter between the circuit earth (not the chassis) and the wiper of VR1, and adjust VR1 until you get a reading of -4.5V.

Check the supply rails to the BBD if you are unable to get the correct bias adjustment. If the LED fails to light, try reversing its leads.

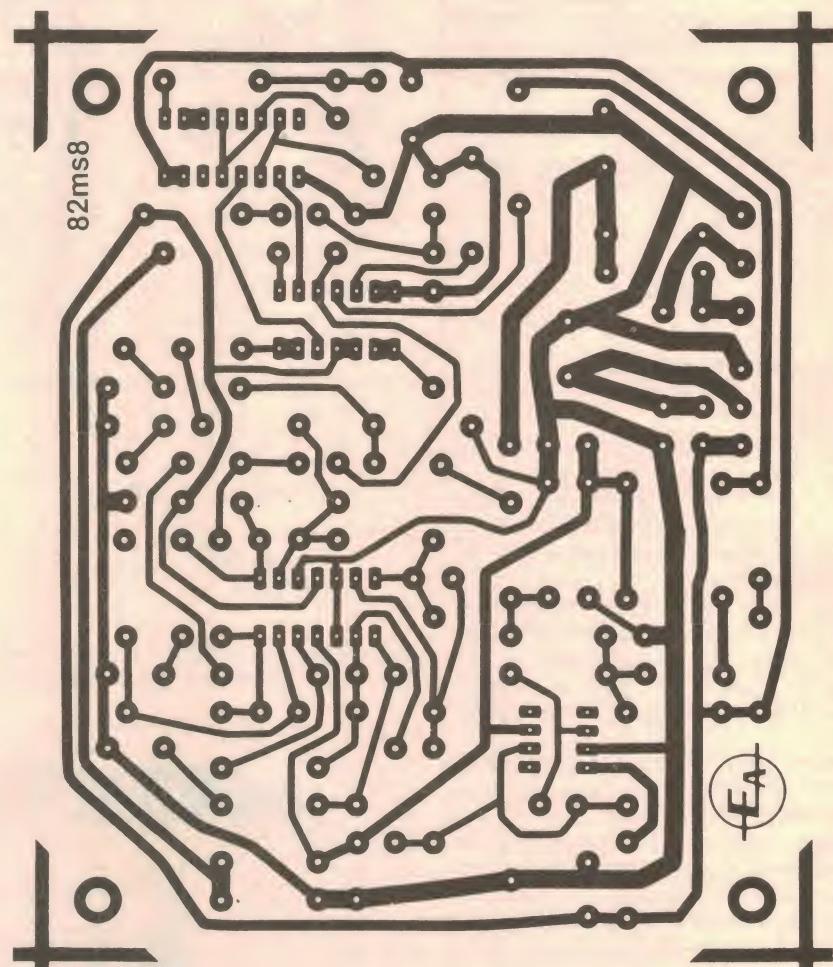
Your Stereo Synthesiser is now ready for use.

Performance

Because of limitations in the BBD device, the unit does not meet hifi specifications but is entirely adequate to enhance the output of a VCR or AM broadcast tuner. The signal-to-noise ratio is around -47dB with respect to 150mV RMS, while harmonic distortion is typically 0.4% at the same output level.

Although labelled VCR and tuner, the two inputs may be coupled to any mono or stereo source capable of delivering 100mV to 1V. The easiest method of connection is simply to interpose the synthesiser between the source and the amplifier, but you could also connect it in the tape loop of the amplifier.

Whatever your source, if it only has a single mono output it should be connected to one of the VCR inputs — it doesn't matter which one. A source capable of either stereo or mono output, such as an AM/FM tuner, should be con-



nected to the left and right tuner inputs. Note that the synthesiser inverts the phase of both channels by 180°, regardless of whether S2 is set to normal (ie, synthesiser bypassed) or synthesiser.

We do not recommend that you con-

nect the synthesiser to your TV unless it has an audio output socket. Many modern receivers have a live (240V AC) chassis, and it's best that you stay well clear unless you know precisely what you are doing!

CAR COMPUTER PART THREE

Our final article this month tells you how to fit the fuel flow and distance sensors to the vehicle, and describes how the Car Computer is operated. Also included is a listing of the EPROM program.

by JOHN CLARKE and GREG SWAIN

Before actually describing how the sensors are fitted to the vehicle, we should first point out that the Prince fuel flow sensor will not now be available with this kit. We learned of this situation shortly after the August issue went to press, and by that stage it was too late to make any alterations.

This means that kit suppliers will only be supplying the Moray fuel flow sensor, which is all to the good. As explained last month, the Moray sensor is the preferred unit as it allows a one second update time for instantaneous fuel consumption. The Prince unit, by comparison, was only good for eight second update times.

The way in which the sensors are fitted will be largely self-evident from the accompanying diagrams. Fitting is straightforward, although dirty hands and bruised knuckles are par for the

course when working with any motor vehicle. We suggest that constructors read this article carefully, as there are a number of important guidelines that must be followed.

Fuel flow sensor

The fuel flow sensor is fitted in the fuel line between the fuel pump and the carburettor — preferably after the fuel filter (see Fig. 1). It should ideally be mounted vertically, but if it has to be mounted horizontally it should be fitted with the fuel passage above the detector housing. The arrow on the side of the sensor must point in the direction of flow; ie, towards the carburettor.

In cars which use flexible hosing between the fuel pump and carburettor, it is simply necessary to disconnect the hose at the pump end (assuming a mechanical fuel pump with integral filter) and insert

the flow sensor in the line. If a metal fuel line is used, it will have to have a suitable length cut out of it. Remove the fuel line from the vehicle before cutting so that the ends can be satisfactorily deburred and any filing cleaned away.

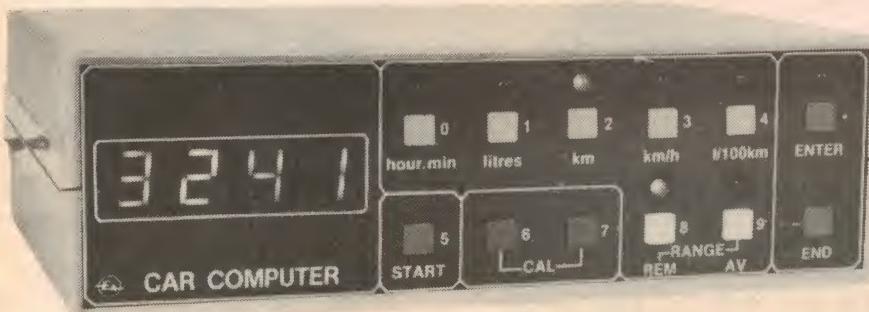
Use only genuine fuel line hose to make the interconnections to the sensor. Do not use nylon tubing or any other type of hose not designed for petrol, as it will become hard and prone to leakage within a short period of time. Secure each connection with a hose clamp to prevent leakage.

Because of its light weight, the Moray fuel flow sensor can usually be mounted suspended in the fuel line without the need for a supporting bracket. Avoid close proximity to ignition leads, and keep it well away from the exhaust manifold to avoid the possibility of vapour lock. You should also ensure that the sensor is correctly oriented, that all clamp connections are tight, and that the hoses are not kinked or stressed.

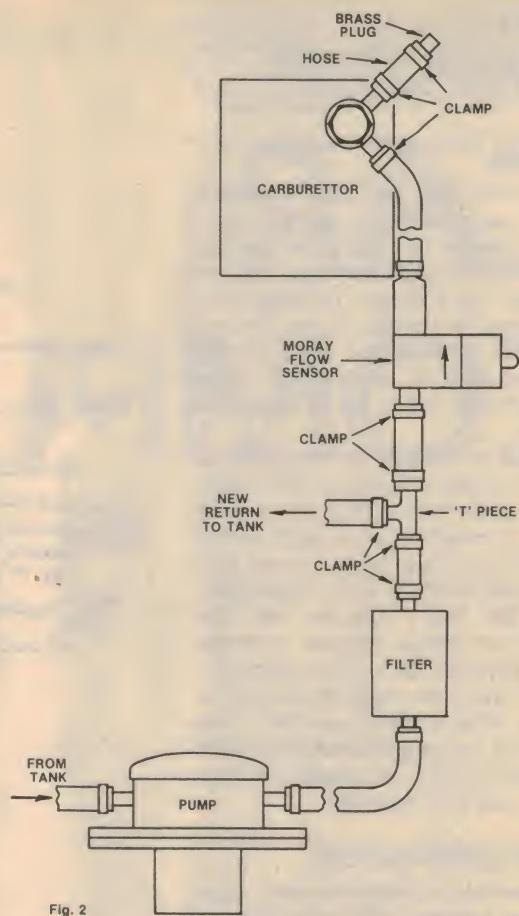
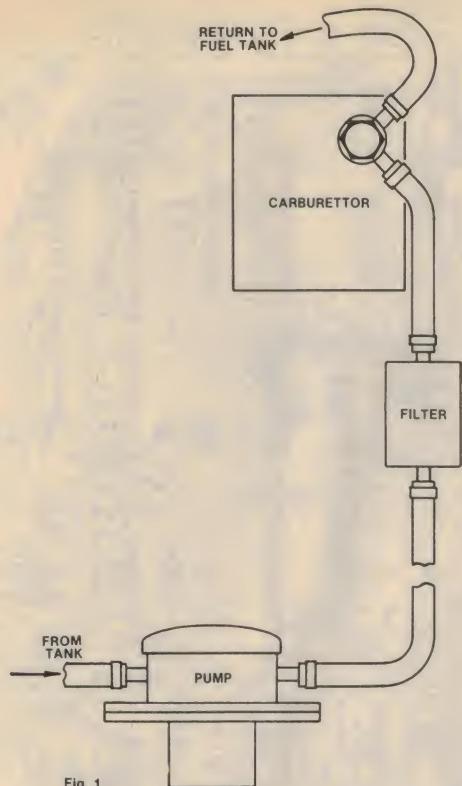
On vehicles fitted with a recirculating fuel system, the flow sensor should be fitted as shown in Fig. 2. A car with a recirculating fuel system is one in which petrol is not only pumped to the carburettor, but is pumped back to the fuel tank as well. If your car has a second pipe connected to the fuel line union at the carburettor, and which runs back to the tank, then it has a recirculating fuel system (see Fig. 1).

Fairly obviously, any fuel returned to the tank must bypass the fuel flow sensor otherwise we would get an incorrect reading of fuel usage. This problem is overcome by fitting a T-junction into the fuel line between the pump and the flow meter. The original return is then blocked off using a suitable brass plug secured by a clamp.

Make sure that the stem of the T-junction is used for the return to the



Car Computer can be mounted at any convenient location on or under the dashboard. Unit is easy to operate and calibrate. (see text).



Figs. 1 & 2: fitting the fuel flow sensor to a car with a recirculating fuel system. Mount the sensor vertically, with the arrow pointing in the direction of the flow.

tank, as this contains a restricting orifice which limits the return flow. On some cars, a T-junction is fitted between the pump and carburettor as standard, in which case the flow meter should be fitted after the T-junction.

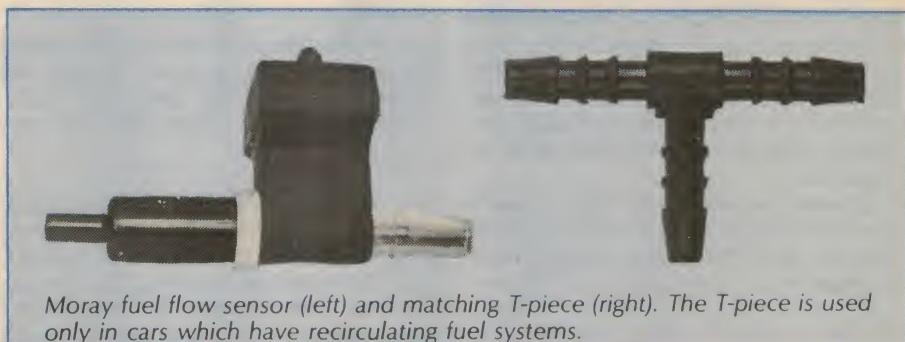
WARNING: some cars, such as the Holden Commodore, are fitted with a vapour recovery system employing a charcoal canister. This is NOT the same as a recirculating fuel system, and on no account should you tamper with the vapour recovery line between the charcoal canister and the carburettor. If in doubt, consult your local dealer.

Unfortunately, the Moray fuel flow sensor cannot be used with fuel injection or diesel engines.

Distance sensors

As stated last month, two different distance sensors can be fitted: (1) a magnetic pick-up using a coil and rotating magnets, or (2) a speedometer cable sensor. Generally, the magnetic pick-up system will suit most rear-wheel drive cars with a front-mounted engine, as the tail shaft is an ideal position for the magnets. It may also be possible to find a suitable position for the magnets on some front-wheel drive cars.

Figs. 3 and 4 show how the magnetic



Moray fuel flow sensor (left) and matching T-piece (right). The T-piece is used only in cars which have recirculating fuel systems.

pick-up sensor is installed in rear-wheel and front-wheel drive cars respectively. In the case of a rear-wheel drive car the sensor should be mounted as close to the gearbox as possible, where vertical movements of the tail shaft are minimal. The magnets are secured to the tail shaft using tie wire and epoxy adhesive.

We used four 15mm-dia round magnets in all, two mounted side-by-side at each position to compensate for any longitudinal movement of the tail shaft (see Fig. 3). Some kit suppliers, however, will be supplying 25mm-long bar magnets, in which case only one magnet will be required at each position.

The coil was mounted on an L-shaped bracket made from aluminium and

secured to the underside of the car using self-tapping screws. This bracket should be positioned so that there is a 10mm gap between the end of the coil and the magnets when they are directly opposite each other. Be careful not to damage any wiring cables running along the floor when drilling the mounting holes for the bracket.

Wiring to the coil can be run along the underside of the car, with the leads secured at various points as convenient. Do not connect the earth lead to chassis at the coil mounting position. Instead, we suggest that both the earth and signal leads be run as a twisted pair all the way back to the rear panel socket on the computer. Plastic tubing can be used to

CAR COMPUTER

protect the leads against damage from flying stones.

Front-wheel drive cars are a somewhat different proposition. In some cars, it may be possible to mount the magnets on a drive-shaft coupling flange where it bolts onto the transaxle (provided it is not covered by a rubber boot). The coil could then be mounted on a suitable bracket secured to the nearest convenient mounting point. Fig. 4 shows the basic idea.

Note that in this case the magnets are mounted at four positions, 90° apart. The reason for this is that, for a given speed, a front-wheel drive shaft rotates about three to four times slower than the propeller shaft on a rear-wheel drive vehicle. The extra magnets are thus necessary in order to get a similar number of pulses for a given distance.

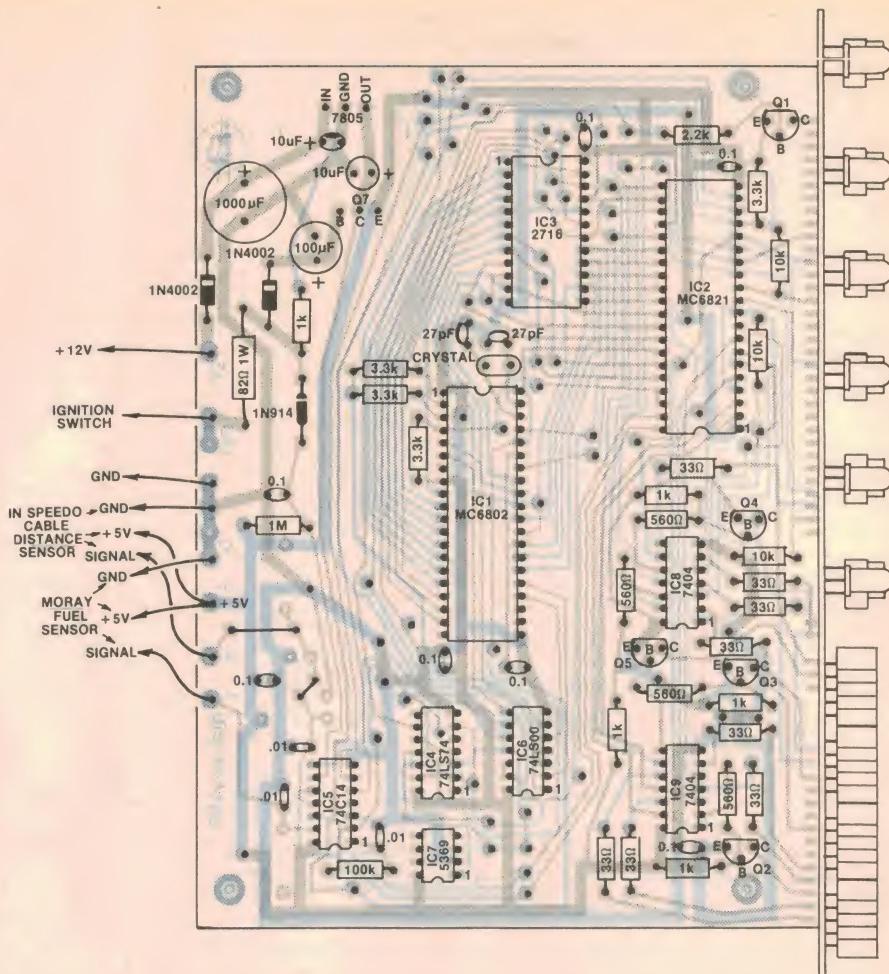
Do not mount the magnets directly onto one or other of the drive shafts. They move about too much when the vehicle is in motion to allow for reliable coupling between coil and magnets.

Speedo cable sensor

The alternative speedometer cable sensor can be used with both front and rear-wheel drive cars, but is mainly applicable to front-wheel drive cars where the drive shaft flanges are not accessible. In order to fit it, the outer sheath must be removed from the speedometer cable and cut at a suitable point. The inner cable is then pushed through the sensor and the speedometer cable reassembled.

Generally speaking, the best position for the speedometer sensor is close to the firewall in the engine compartment. The installation procedure is as follows:

- Mark the appropriate position with white chalk, then remove the speedometer cable from the vehicle;
 - Remove the retaining circlip and withdraw the inner cable;
 - Using a hacksaw, cut out and discard a 15mm section of the outer sheath at the marked position;
 - Push the inner cable through the sensor and refit the two sheath sections by clamping the ends in the slotted end tubes. Note that the inner cable should be a force fit into the sensor, otherwise the slotted disc inside the sensor will not rotate;
 - Check that the inner cable is free to rotate, then re-install the speedometer cable in the vehicle.



Follow this parts overlay diagram if the speedometer cable distance sensor is used. If the magnetic pick-up sensor is used, the parts overlay diagram in the August issue should be followed, but note that the $4.7k\Omega$ resistor must be deleted to accommodate the Moray fuel flow sensor.

As supplied, the speedometer cable sensor can be fitted to most speedometer cables. Readers should note, however, that it cannot be used in vehicles fitted with an electronic speedometer - eg XD and XE Ford Falcons - for the simple reason that such vehicles do not have a speedometer cable!

If you do elect to fit the speedometer cable sensor, then the PCB parts layout diagram accompanying this article should be followed. If the magnetic pick-up sensor is used, then the overlay diagram in the August issue should be followed but don't forget to delete the $4.7\text{k}\Omega$ resistor in order to accommodate the Moray fuel flow sensor.

Once the sensors have been installed, the wiring to the Car Computer can be completed. Fig. 5 shows the recommended wiring to the 12-pin Utilux socket, as viewed from the front. The leads from the sensors are passed

through the firewall, and terminated to the appropriate mating pins on the matching plug. Make sure that you get these connections right, otherwise the circuitry could be damaged.

The +12V from the ignition switch and the permanent +12V supply can be obtained from the fusebox. Check the voltages available with a multimeter before actually connecting the leads, and make the connections to the fused side. The ground connection can be made at any suitable chassis point.

The Car Computer itself can be mounted at any convenient location on or under the dashboard, using a suitable U-shaped bracket. We'll leave it to readers to work out mounting details to suit individual model cars.

Operation

At first switch on, all memory locations have random numbers located in them. Press the START key to clear hour,min.

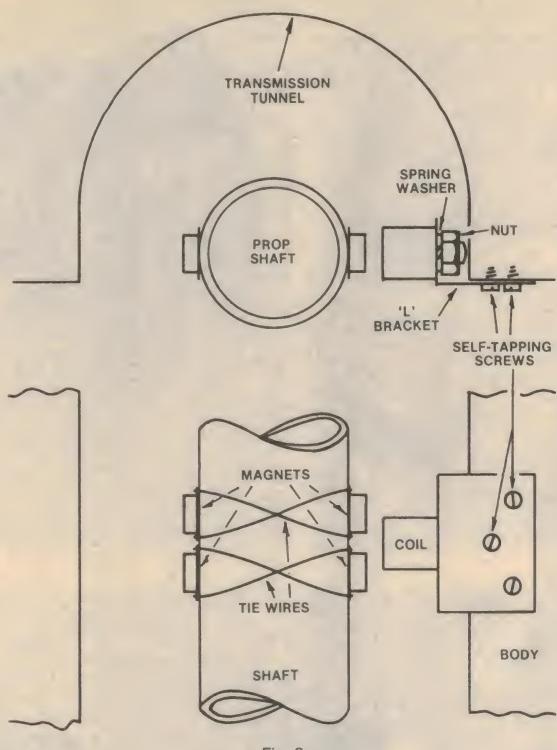


Fig. 3

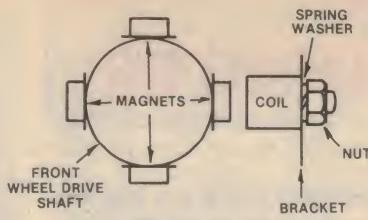


Fig. 4

Fig. 3 (left) shows how the magnetic pick-up sensor is installed in a rear-wheel drive car while Fig. 4 (above) shows the installation for a front-wheel drive car (see text).

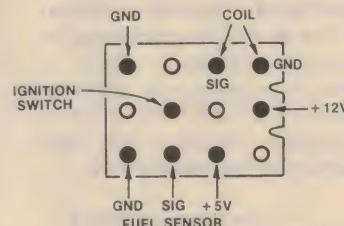


Fig. 5

Fig. 5: recommended wiring for the 12-pin Utilux socket, as viewed from the front. An additional connection to +5V will be required if the speedometer cable sensor is used.

litres, km, and their associated pulse count memories. Data to be entered initially includes the maximum fuel tank capacity, and the litres CAL and km CAL calibration numbers. The fuel remaining (litres REM) and journey length (km REM) figures must also be entered initially and, subsequently, each time fuel is added to the tank or a "new" journey undertaken.

Let's go through the procedure step-by-step:

● **Litres CAL.** The number to be entered here is the number of pulses that the fuel sensor provides for 0.1 litres of fuel flow. Each Moray sensor is precalibrated by the manufacturer, and a small tag on the sensor lead provides a clue to the calibration number to be used. On one side of the tag is a number for litres, and on the other a number for gallons. All you have to do is multiply the litre reading by 25.6 to get the litre CAL number for that particular sensor. For example, our Moray sensor has the number 67; multiplying this by 25.6 gives a calibration number of 1715 pulses per 0.1 litres.

To enter this number, first press the litres CAL key switch (key switch 6). The display should show a random number. Now press the ENTER key switch – the display will clear and the ENTER LED will light. Finally, enter the calculated calibration number and press the END key to extinguish the ENTER LED. For example, to enter 1715 press 6, ENTER, 1, 7, 1, 5, END.

The display will now show the calibra-

tion number just entered. If you are not convinced, press another function key and then return to the litres CAL key. The previously entered number will again be displayed. Note that although a decimal point can be entered into the calibration number, this will be totally ignored by the computer. After the END key is pressed, the decimal point will disappear.

It is a good idea to write the calibration number down and keep it in a safe place as it will have to be re-entered each time the battery is disconnected from the vehicle. The same applies to the distance calibration number (see below) and any other enterable data.

● **km CAL.** This is the number of pulses received from the distance sensor in one

kilometre. If you are using a magnetic pick-up sensor mounted on the tail shaft, an approximate distance calibration number can be calculated. Measure the wheel diameter (the horizontal distance) in mm, multiply by 3.14 (π) and divide the result into 1 million. This gives the number of wheel rotations per kilometre. Multiplying this value by the differential ratio of the particular car and then by two (two magnets on the shaft) will then provide an approximate number for the distance calibration.

The actual number will be in the region of 4000.

To enter the distance calibration number, first press the distance CAL key switch (key switch 7) followed by the ENTER button. The calibration number

The speedometer cable distance sensor can be used on both front and rear-wheel drive cars, but not on cars which have an electronic speedometer (eg, XD, XE Ford Falcon).



CAR COMPUTER

can now be entered and the END key pressed to extinguish the ENTER LED (eg to enter 4000 press 7, ENTER, 4, 0, 0, 0, END).

The alternative speedometer cable sensor provides a similar number of pulses per kilometre, although the actual value is not as easy to calculate. You can, however, arrive at an approximate value by first entering a calibration number of 4000 and then comparing the indicated km/h reading on the Car Computer with the speedometer reading. The new distance calibration number is then:

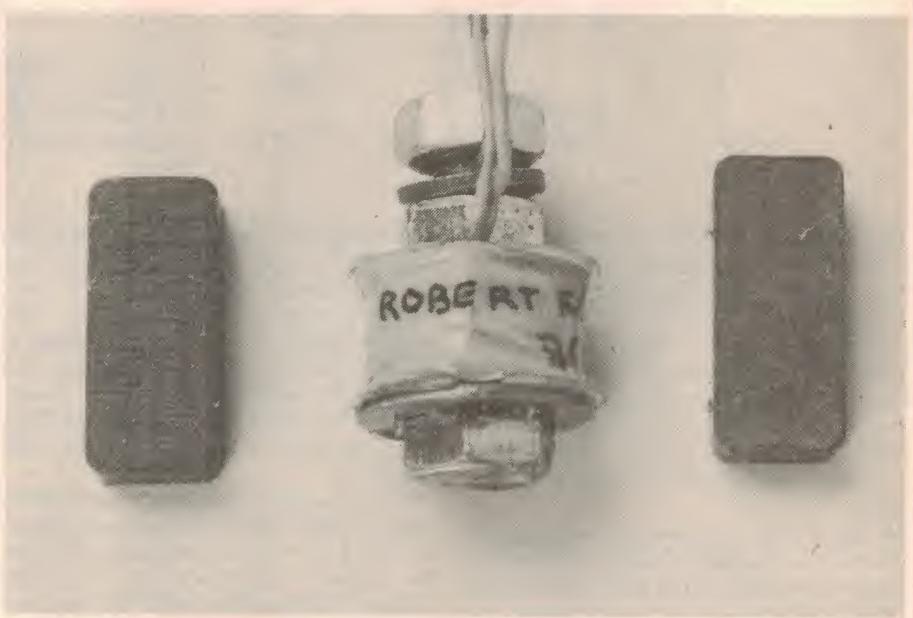
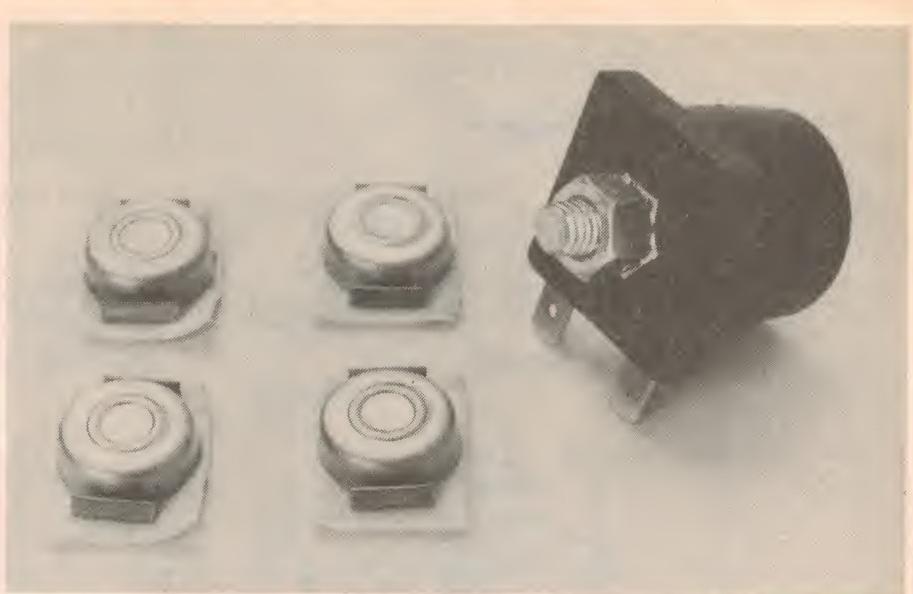
$$\text{km CAL} = 4000 \times \frac{\text{Computer reading}}{\text{Speedometer reading}}$$

Note that the maximum calibration number that can be fed in is 9999. If the calculated calibration number is greater than this, you will have to dismantle the sensor and remove half the number of vanes (either that, or use the magnetic pick-up).

The exact distance calibration number (both types of sensors) can now be found using one of two methods. First, a direct comparison can be made between the km reading on the Car Computer and the car's odometer. Zero the odometer trip meter, press the START button on the computer, and drive the car for 15-20km (longer journeys will give a more accurate result). The true calibration number is now calculated by multiplying the old calibration number by the computer reading and dividing by the odometer reading.

A more accurate method involves checking the indicated distance on the Car Computer against the kilometre marking posts located alongside major highways. If you do use this method, don't be surprised if the km and km/h readings on the Car Computer differ from the values indicated on the speedometer. Car speedometers are not particularly accurate devices!

● **km REM.** Press the km and REM keys and the associated LEDs will light, displaying the km REM value. Initially, a random number will be displayed. Once entered, the km REM value will be reloaded into the km REM memory each time the START key is pressed unless another distance is entered. This value will decrease by 1km for every kilometre travelled until zero is reached, after which the display will count down from 9999km.



Two versions of the magnetic pick-up sensor currently available from kit suppliers. See Figs. 3 & 4 and text for installation details.

To enter data, press km, REM and ENTER, enter the expected distance, and press the END key. For example, to enter a journey length of 483km press km, REM, ENTER, 4, 8, 3, END. Note that entering a decimal point will cause a "d.Err" to be displayed, indicating that the value will have to be entered again.

If the estimate for the distance of the journey is subsequently found to be incorrect, the km REM value can be changed at any time. The hour:min REM is automatically corrected for the new value.

● **litres REM RANGE.** This value is the maximum capacity of the fuel tank to the nearest 0.1 litres, as specified in the vehicle handbook. The value stored is actually provided for convenience when the

tank is filled, since it can be directly entered into the litres REM memory. Press litres, AV and ENTER, enter the tank capacity, and then press END. Note that the entry must be made to the nearest 0.1 litres, otherwise "F.Err" will appear on the display.

● **litres REM.** This is the actual amount of fuel in the tank, so new data must be entered each time fuel is added. Initially, a random number will appear and you will have to determine and enter the amount in the tank. The easiest method is to fill the tank and then enter the tank capacity. This is done by pressing litres and AV (to display the tank capacity), followed by ENTER and END. Do not enter any numbers. The litres REM RANGE value will now be stored in the

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CAR COMPUTER

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- ELAPSED TIME
- SPEED IN K'S/HR. MORE ACCURATE THAN CAR SPEEDO
- DISTANCE TRAVELED/REMAINING
- HOW FAR YOU CAN GO ON FUEL LEFT

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All Electronics including both PCB's plated-through, programmed EPROM, 1% metal film resistors, high spec components and YOUR CHOICE of either speedometer cable speed sensor OR tailshaft sensor. (Please specify)

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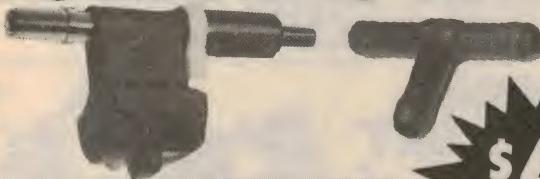
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\$45

speed sensors

Two types available. Both operate with the EA Car Computer and give much the same results. The speedo cable unit is handy for front-wheel drive or cars which have no tailshaft. This unit does require the speedo cable. Outer sheathing of the cable does not affect the operation of the speedometer in any way and can be used with tailshaft cars also. The magnet coil unit is only really suitable for cars fitted with tailshafts, but the speedo cable is not touched.



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Build it yourself from a Dick Smith Kit!

Why pay for commercial equipment when, with just a few hours of your time, you can build it yourself with the aid of a Dick Smith Kit. Because you supply the labour, you can save \$\$\$! AND what's more, it's great fun. So have a go and do it yourself. Your friends will never believe you built it!



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Cat. K-3600

The Electronics Aust./ Dick Smith SUPER 80 A FULL SIZE COMPUTER

You are supplied with a full board including power-on EPROM monitor, 16K of RAM, cassette interface (relay activated) for universal control of any tape recorder, TV modulator and direct video output PLUS full size professional keyboard — not a 'feel less' toy!

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* now only →

\$239⁵⁰

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Transformer (M-2325)	\$23.00
BASIC Interpreter (tape) (K-3602)	\$12.50
IC Socket Set (K-3603)	\$12.50
Lower Case Generator Option (K-3607)	\$49.00
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Metal Case (H-3200)	\$44.95
SUPER 80 Technical Manual (B-3600)	\$9.50
SUPER 80 BASIC Handbook (B-3602)	\$9.50



★ DICK SMITH DELUXE COUNTER

The experimenter's delight! Every hobbyist at some time needs a counter. Here's one that won't break the bank. A deluxe fibreglass PCB with all counter components are supplied — and you can use this as a base for a huge number of projects. Operates from 5 to 15V supply. Exclusive to Dick Smith Electronics, with our own specially prepared instruction manual showing not only how to build it, but a number of experiments too!

\$29⁵⁰ ★

Cat. K-3451

AND A NEW PANEL METER MODULE!



An incredibly versatile and highly accurate panel meter with a highly visible LCD display with HUGE 15mm digits. Uses the famous 'Intersil' chip (as used in a huge number of professional test circuits), and its low cost makes it an extremely attractive and viable replacement for conventional analog equipment. The display is removable from the rest of the PCB for remote or angled placement. Fantastic! Full scale: 200mV; Resolution: 100uV; Power Supply: 5-15VDC.

\$29⁵⁰

Cat. K-3450

DRILL SPEED CONTROL

\$13⁹⁵

OVER 10,000 SOLD!

Unique speed control for your drill: goes down to near zero without excessive torque loss. Complete with 3 pin mains socket, insulated knob and Marvi-plate front panel. Robust and effective — easy to build. SEE EA JULY '82

Cat. K-3080



HIGH POWER SUPPLY 13.8V @ 7.5A (10A Pk)

At last — the project you've waited for. Great for high power transceivers, a service bench supply — you name it! Very sturdy case for maximum protection — professional quality, complete with handles for easy movement. Plus a special screened front panel and huge colour-coded output terminals with a massive heatsink for maximum dissipation. And the protected output means you won't cook the supply (also has LED overload indicator)! A bewdy!

Cat. K-3452

SEE ETI JULY '82

\$79⁵⁰



Play It! ELECTROCHUNE

The Electrochune features a built-in amplifier and speaker with separate volume control. Comes complete with plugpack and full instructions. SEE EA JUNE '81. Cat. K-3506

was \$75.00! \$57⁵⁰

DICK'S ORIGINAL 1952 CRYSTAL SET

Want a radio that works during blackouts and doesn't need batteries? Then this is just for you! Dick's own crystal set kit. A satisfying project that will give you lots of fun. It can pull in a surprising number of broadcast stations and produce good sound even when connected to a stereo system.

SEE EA APRIL '82. Cat. K-2650

only \$6⁹⁰



* Boost It! * STEREO BOOSTER AMP



Road noise beating you poor car stereo? Amplify it: this superb stereo amplifier is easy to build, easy to connect. Special high-transfer aluminium heatsink also doubles as a handy mounting bracket.

Cat. K-3493 SEE EA JANUARY '79

\$29⁵⁰



EARPHONES CHOOSE OPTIONAL HEARING DEVICE

Crystal — high impedance earpiece with 3.5mm plug. Budget priced! Cat. C-2765

\$1.75 each

Magnetic — high impedance. Ideal for your crystal set. As used by spies everywhere! Cat. C-4000

\$7.95 each

CORE BALANCE RELAY

Here is a kit that will protect you AND your equipment. This portable unit features a tough moulded plastic case and comes complete with special front panel and double power outlet. At this low Dick Smith price, it doesn't cost the earth to play it safe! Cat K-3315. SEE EA APRIL '81

**was
\$52.00!**



*** now only \$45⁰⁰**

MAKE A BIT OF NOISE! HOT CANARY

Give your budgie something to worry about! This kit uses just one CMOS IC to generate the beautiful whistling and chirping of two canaries! Comes complete with Zippy box and speaker. Cat. K-3395 SEE EA MAY '81

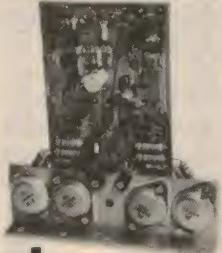


\$15⁵⁰

100 Watt Amp. Module

100 Watts RMS — 5Hz to 50kHz at 100dB signal to noise. ETI 480 short form amplifier kit. The ultimate in simplicity — even the power transistors mount on the one PCB. The PCB heatsink bracket is supplied with the silk-screen overlay on our fibreglass heavy-duty PCB. The design is based on the time-proven ETI 422 power amp, without the power transistor wiring hassles. Use with K-3438 power supply (see below). SEE ETI DECEMBER '76.

Cat. K-3442



only \$25

50 Watt Amp. Module

Ideal for home stereo systems for those who feel 100W - 100W is too much. Same design, same simplicity as 100W unit above. Added economy as two units can be run from the K3438 power supply. An economical solution for those who want to update their old system without a huge outlay of money. Supplied with special DSE instruction booklet and rugged fibreglass PCB with silk-screened component overlay for easy assembly. Heatsink bracket supplied but heatsink is extra. SEE ETI DECEMBER '76.

Cat. K-3440

only \$19⁹⁵

Power Supply ETI 480

Full PCB and component kit for one K-3442 or two K-3440 modules. Supplied complete with speaker de-thump relay and Zener regulated + and -15V pre-amp rails. Assembly instructions supplied. Transformer extra.



Cat. K-3444

SEE ETI DECEMBER '76. Cat. K-3438

only \$19⁹⁵

300 Watts RMS Amplifier

This is the ideal unit for public address, rock groups etc., or where high power is required. Kit comes complete with all components and instructions to produce 300W RMS into 4 ohms using one module or a truly massive 600W RMS continuous power using two units. Of course, only quality components are used! SEE ETI FEBRUARY '80

Not including transformer or heatsink

only \$72

DICK SMITH Electronics



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SEE PAGE 98 FOR ADDRESS DETAILS

Transistor Assisted Ignition

This great little money saver comes complete with a custom made aluminium box that is pre-drilled. All components are supplied plus deluxe heatsink and full instructions. Cat. K-3300. SEE EA NOVEMBER '79



was \$34.00!

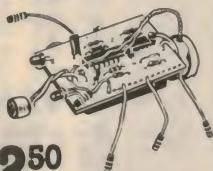
now only

\$29

**this
month only!**

CUDLIAPP

This cute little electronic insect will drive your friends crazy! He speaks when others do, but when all the quiet, he doesn't make a sound! Cat. K-3397 SEE EA FEBRUARY '82



only \$12⁵⁰

PARTS FOR NEW KITS

Special parts for kits which are not in our current catalogue (or may be hard to find!)

CORE BALANCE RELAY - SEE ETI APRIL '81 (CAT K-3315)
PL24.5VA Transformer Cat. M-3590 \$8.95

SUPER 80 COMPUTER - SEE EA AUG '81 (CAT K-3600)

20k 10 turn trimpot Cat. R-1970 \$2.60

Mini 5 volt relay Cat. S-7105 \$3.75

12MHz crystal Cat. K-6035 \$3.50

2716 EPROM Cat. Z-92C7 \$12.50

S-100 Edge Connector Cat. P-2570 \$9.75

DIGITAL FREQUENCY COUNTER - See EA Dec '81 (Cat K-3493)

Deluxe instrument case Cat. H-2505 \$12.50

(above case is also used in function generator & new car computer) Cat. H-6032 \$4.95

FUNCTION GENERATOR - See EA April '82 (Cat K-3520)

FND500 LED displays Cat. Z-4150 \$1.35

XR2206 IC Cat. Z-6820 \$6.95

Slide Switch - 3 pole 3 position Cat. S-2070 .95c

Slide Switch - 2 pole 3 position Cat. S-2030 80c

Slide Switch - 2 pole 2 position Cat. S-2040 65c

150W MOSFET AMPLIFIER - See ETI May '82 (Cat K-3252)

2SK134 FET Cat. Z-1815 \$7.90

2SJ49 FET Cat. Z-1816 \$7.90

PCB Cat. H-8644 \$6.50

/PCB for mosfet amp preamplifier Cat. H-8646 \$6.50

NE55534 IC Cat. Z-6090 \$4.50

ELECTRONIC RULE - SEE EA AUG '82

Ultrasonic transmitter Cat. L-7050 \$4.95

Ultrasonic receiver Cat. L-7052 \$4.95

All other parts for this kit are normal stock lines

MAINS WATT METER - SEE EA JULY '82

Moving iron panel meter Cat. Q-2090 \$7.95

All other parts for this kit are normal stock lines

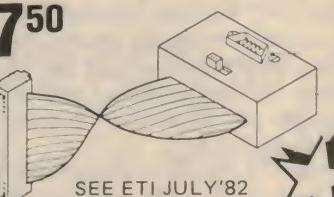
* * * * *

JOYSTICK ADAPTER KIT

Ever wish you could hook up a joystick to your System 80, so could play games faster and with greater realism? Well, your wish has been answered. This little adapter won't strain your piggy bank and can be assembled very easily. It plugs in, and away you go! Cat. K-3455

NOTE: Compatible with most U.S. games software designed to work with the 'Alpha' joystick.

\$37⁵⁰



SEE ETI JULY '82

MATCHING JOYSTICK

This is the joystick to go with the above adapter. Standard Atari-type joystick, with sensors for four primary directions of motion and separate 'fire' button. Complete with cable and DB-9 connector. (Also suit VIC-20 computer). Cat. X-2020



only \$19⁹⁰

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CATALOGUE!**



DSE/A329/LM

CAR COMPUTER

litres REM memory, and this can be verified by pressing the litres and REM keys.

If the fuel tank is not completely filled, the extra fuel must be entered and added to the litres REM memory. To do this, press litres, REM and ENTER, enter the amount of fuel added to the tank, and press END. The entered value will be automatically added to the previously displayed litres REM reading. Once again, fuel must be entered to the nearest 0.1 litres otherwise "F.Err" will be displayed and the entered fuel will be ignored.

Error correction

Mistakes made in entering data, other than litres REM, are easily corrected by pressing END and ENTER, then re-entering the correct value. An incorrect litres REM entry is a little trickier, however, since the entered value is actually added to the previous value. Basically, you've got three choices:

If the decimal point has not been entered when the mistake is realised, press the END key to display "F.Err". This will prevent the entered value from being added to the previous value. All you have to do now is re-enter the correct value.

If the decimal point has been entered but the END key not pressed, the situation can be retrieved by typing in several leading zeroes followed by the correct number. Entering is cyclic, so any digits re-entered will overwrite the previously entered digits.

If, however, the decimal point and END keys have both been pressed, display litres REM RANGE, enter the previous litres REM value (assuming that you can remember what it was), and transfer this value to litres REM (see above). The fuel added is now re-entered in litres REM, and the correct fuel tank capacity re-entered in litres REM RANGE. If you are unable to remember what the previous litres REM value was, then you will have to fill the tank completely and transfer the litres REM RANGE value to litres REM.

Troubleshooting

If your Car Computer does not work, don't rush out and buy new ICs. Provided that they've been installed correctly and that the power supply is correct, the ICs are not likely to be at fault. Instead, go over the project carefully and check that you've inserted all pin-throughs (for

CAR COMPUTER EPROM PROGRAM

```

0000 86 C9 B7 80 05 86 FF B7 80 04 B6 80 05 8A 04 B7
0010 80 05 F6 80 04 86 F1 B7 80 07 86 F8 B7 80 06 B6
0020 80 07 8A 04 B7 80 07 7F 00 20 96 1E 81 00 26 03
0030 7E 62 22 81 01 26 03 7E 63 A8 81 02 26 03 7E 62
0040 71 81 03 26 03 7E 63 62 81 04 26 03 7E 63 85 81
0050 07 26 03 7E 62 FB 81 06 26 D6 20 F7 7F 00 54 96
0060 54 81 00 26 2C 96 20 81 01 27 F4 96 1E 81 07 27
0070 EE 81 06 27 EA 81 05 27 E6 96 2C 81 3B 27 E0 96
0080 06 81 01 26 04 97 54 20 48 BD 65 ED 7C 00 5B 20
0090 CE CE 61 2A 96 54 5F A1 00 27 0B 08 5C 8C 61 36
00A0 27 02 20 F3 20 B6 C1 0B 27 20 96 20 81 01 27 28
00B0 C1 0A 27 10 C1 08 27 17 C1 09 27 13 D7 1E 7F 00
00C0 1F 7E 60 2A C6 01 D7 20 20 F7 7F 00 20 20 F2 D7
00D0 1F DE 26 08 DF 26 20 E9 A6 0C 20 2E 96 54 81 01
00E0 27 15 CE 09 00 09 26 FD 0E 96 23 B1 00 5A 27 07
00F0 86 FD B7 80 07 20 F1 DE 26 9C 28 27 06 09 DF 26
0100 7E 60 5C 08 08 08 DF 26 20 F6 81 00 27 06 DE 26
0110 A7 00 20 C8 DE 26 08 D6 29 5C 5C 5C D1 27 27 BC
0120 A6 00 8A 80 A7 00 DF 26 20 B2 22 42 0C 14 24 11
0130 09 21 41 44 0A 12 7E 44 3D 6D 47 6B 7B 4C 7F 6F
0140 00 97 21 DF 37 D6 37 C4 F0 8D 23 D7 2D D6 37 C4
0150 0F 8D 20 D7 2C D6 38 C4 F0 8D 13 96 21 81 20 26
0160 02 CA 80 D7 2B D6 38 C4 F0 8D 08 D7 2A 39 0C 56
0170 56 56 56 D7 60 CE 61 36 4F 91 60 27 08 4C 08 81
0180 0A 27 05 20 F4 E6 00 39 C6 7F 39 FF FF FF 96 2A
0190 84 7F 7F 00 21 8D 4E DE 37 E7 00 96 2B 85 80 26
01A0 25 8D 3B DE 37 EA 00 E7 00 96 2C 85 80 26 1F 8D
01B0 34 DE 37 09 E7 00 96 2D 85 80 26 1A 8D 20 DE 37
01C0 09 EA 00 E7 00 39 C6 20 D7 21 84 7F 20 D3 C6 40
01D0 D7 21 84 7F 20 D9 C6 80 D7 21 84 7F 20 DE 8D 05
01E0 58 58 58 39 5F CE 61 36 81 00 27 08 A1 00 27
01F0 04 08 5C 20 F8 39 CE 00 2F DF 26 CE 00 2A DF 28
0200 7E 60 DC 86 00 09 0C 66 00 08 66 00 4C 81 04 26
0210 F4 39 96 2E 8A 20 97 2E CE 00 00 DF 2A DF 2C 7E
0220 60 DC D6 1E C1 00 27 28 7F 00 2E DE 00 DF 12 CE
0230 00 00 DF 04 DF 08 DF 0E DF 06 DF 0A DF 10 86 1A
0240 97 2D 86 3B 97 2C 86 75 97 2B 86 67 97 2A 20 15
0250 D6 1F C1 08 27 15 C1 09 27 0B DE 04 86 01 97 2E
0260 86 00 BD 61 41 7F 00 20 7E 61 F6 86 81 DE 02 20
0270 ED D6 1F C1 00 27 31 C1 09 27 3A 96 20 81 01 27
0280 24 96 2E 81 A4 27 32 20 28 7F 00 20 D6 1F C1 08
0290 27 0B C1 09 27 0B 86 04 97 2E 7E 61 F6 86 84 20
02A0 F7 86 C4 20 F3 7E 62 12 DE 0E 86 00 BD 61 41 20
02B0 D8 DE 12 20 F5 DE 33 20 F1 86 13 97 38 7F 00 37
02C0 BD 61 8E CE 00 13 86 00 91 2C 27 0A 91 2B 27 09
02D0 91 2A 27 08 20 09 BD 62 03 BD 62 03 BD 62 03 96
02E0 21 81 00 27 10 86 F5 97 2D 86 3B 97 2C 86 11 97
02F0 2B 97 2A 20 94 DE 12 DF 00 20 B6 D6 20 C1 01 27
0300 0E 96 2E 85 20 26 1E 20 09 7F 00 2E 7E 61 F6 7E
0310 62 12 96 1E 81 06 27 09 DE 1A 86 00 BD 61 41 20
0320 E8 DE 1C 20 F5 7F 00 37 96 1E 81 06 27 0E 86 1B
0330 97 38 BD 61 8E CE 00 00 DF 10 20 0C 86 1D 97 38
0340 BD 61 8E CE 00 1D 20 03 CE 00 1B 86 00 91 2B 27
0350 06 91 2A 27 05 20 06 BD 62 03 BD 62 03 7F 00 2E
0360 20 B0 D6 1F C1 00 27 06 C1 09 27 13 20 0E 86 08
0370 DE 31 97 2E 86 00 BD 61 41 7F 00 20 7E 61 F6 86
0380 48 DE 14 20 ED 7F 00 20 D6 1F C1 00 27 06 C1 09
0390 27 10 20 0B C6 10 DE 35 86 20 D7 2E BD 61 41 7E
03A0 61 F6 C6 50 DE 52 20 F0 D6 1F C1 00 27 3F C1 08
03B0 27 0E 96 20 81 01 27 32 96 2E 31 E2 27 40 20 3A
03C0 96 20 81 01 27 24 96 2E 81 A2 27 74 20 28 7F 00
03D0 20 D5 1F C1 00 27 0B C1 08 27 0B 86 C2 97 2E 7E
03E0 61 F6 86 02 20 F7 36 82 20 F3 7E 62 12 DE 08 86
03F0 20 BD 61 41 20 D8 DE 0C 20 F5 DE 16 20 F1 7F 00

```

continued on page 69

CAR COMPUTER

boards without plated-through holes) that you've soldered both sides of the PCB as required, that all components are correctly oriented, and that none of the IC pins have been bent under the body of the IC.

Check also that the sensor connections are correct, and that there are no broken or shorted tracks on the PCB. If any of the digits fail to light, check driver transistors Q2 to Q5 and check for continuity between each digit driver output and pin 3 of the corresponding display. Similarly, if any segments fail to light, check for breaks in the segment drive lines between the PIA and the inverters (ICs 8 and 9), between the inverters and the displays, and between the displays themselves.

Detailed troubleshooting will generally require the use of a CRO, although the simple checks outlined above will usually be quite sufficient. For what it's worth, we built up three versions of the Car Computer without encountering any problems.

In use, calculated values such as hours:min REM, km REM RANGE, km/h AV and litres/100km AV will not give sensible readings until several kilometres have been travelled after pressing the START key. The litres/100km reading may also appear to be unusual when the vehicle is braked. As the vehicle slows the fuel consumption initially falls and then dramatically increases just before the vehicle is brought to a stop. This is because, at very low speeds, the distance travelled between fuel pulses progressively decreases while the fuel flow rate remains fairly constant.

The limiting case is obviously at standstill, when fuel is used but no distance is travelled. The litre/100km value then becomes infinite, however the Computer will not display this since no distance pulses are received.

continued from page 68

0400	18	7F	00	19	DE	2C	8C	00	00	27	2F	86	51	97	38	7F
0410	00	37	BD	61	8E	96	21	81	80	27	0A	81	40	27	0C	81
0420	00	27	4A	20	0C	CE	00	51	BD	62	03	CE	00	51	BD	62
0430	03	7F	00	21	DE	50	DF	16	20	C0	DE	16	DF	0C	20	B6
0440	86	51	97	38	7F	00	37	BD	61	8E	96	21	81	80	27	0C
0450	81	40	27	0E	81	00	27	15	20	0E	20	98	CE	00	51	BD
0460	62	03	CE	00	51	BD	62	03	7F	00	21	20	10	86	9B	97
0470	2D	86	3B	97	2C	86	11	97	2B	97	2A	20	DD	96	51	9B
0480	0D	19	97	0D	96	50	99	0C	19	97	0C	20	B1	86	00	97
0490	48	97	47	97	46	97	45	97	42	97	41	97	3E	86	04	C6
04A0	03	CE	00	41	8D	27	26	F7	86	08	97	49	8D	52	8D	6E
04B0	24	05	7C	00	48	20	F7	8D	47	7A	00	49	27	18	8D	5E
04C0	86	04	C6	08	CE	00	49	8D	04	26	F7	20	DF	0C	09	69
04D0	00	5A	26	FA	4A	39	36	04	C6	03	CE	00	3E	66	00	08
04E0	5A	26	FA	4A	26	F2	C6	02	D7	49	CE	00	47	09	A6	00
04F0	E6	02	A7	02	E7	00	7A	00	49	26	F2	DE	47	DF	43	39
0500	C6	03	CE	00	3E	86	99	A0	00	A7	00	08	5A	26	F6	0D
0510	C6	03	09	86	00	A9	00	19	A7	00	5A	26	F5	39	C6	03
0520	CE	00	41	0C	09	A6	00	A9	03	19	A7	03	5A	26	F5	39
0530	DE	05	DF	43	7F	00	44	CE	00	60	DF	3F	BD	64	8D	DE
0540	04	DF	3F	96	44	97	40	DE	0E	DF	43	BD	64	8D	DE	44
0550	DF	14	39	DE	12	DF	43	DE	14	DF	3F	BD	64	8D	96	44
0560	97	02	DE	45	DF	43	CE	01	67	DF	3F	BD	64	8D	96	44
0570	97	03	39	DE	08	DF	43	DE	0E	DF	3F	BD	64	8D	DE	44
0580	DF	52	39	DE	0C	DF	43	DE	52	DF	3F	BD	64	8D	DE	44
0590	DF	33	39	DE	1A	DF	43	CE	36	00	DF	3F	BD	64	8D	DE
05A0	44	DF	57	DE	57	DF	3F	DE	55	DF	43	BD	64	8D	DE	44
05B0	DF	31	39	DE	1C	DF	43	DE	1A	DF	3F	BD	64	8D	DE	45
05C0	DF	57	DE	5E	DF	43	DE	5C	DF	3F	BD	64	8D	96	1C	85
05D0	10	27	13	DE	44	8D	06	DE	45	20	0F	DE	45	DF	43	DE
05E0	57	DF	3F	7E	64	8D	8D	F3	DE	44	DF	35	39	96	06	81
05F0	09	27	1A	81	02	27	19	96	5B	81	01	27	16	81	02	27
0600	15	81	03	27	14	81	04	23	13	7F	00	5B	39	7E	65	B3
0610	7E	65	93	7E	65	30	7E	65	53	7E	65	73	7E	65	83	B6
0620	8U	07	F6	80	06	85	80	27	04	BD	66	D8	3B	86	01	97
0630	59	B6	80	05	F6	80	04	8A	3F	81	BF	27	09	81	7F	27
0640	0A	81	FF	27	0B	3B	BD	66	59	20	0A	BD	66	A3	20	05
0650	BD	66	59	20	F6	7F	00	59	3B	CE	00	30	8D	35	CE	00
0660	11	8D	30	CE	00	3A	8D	2B	DE	10	9C	1A	27	01	39	7F
0670	00	10	7F	00	11	CE	00	0F	8D	19	CE	00	13	8D	01	39
0680	8D	06	25	03	09	8D	01	39	86	99	80	01	0D	A9	00	19
0690	A7	00	39	A6	00	8B	01	19	A7	00	09	A6	00	89	00	19
06A0	A7	00	39	CE	00	0B	8D	EB	CE	00	19	8D	E6	CE	00	3C
06B0	8D	E1	DE	0A	9C	1C	27	07	DE	18	9C	1C	27	0E	39	7F
06C0	00	0A	7F	00	0B	CE	00	09	8D	C9	20	EC	CE	00	0D	7F
06D0	00	18	7F	00	19	8D	A9	39	96	06	4C	81	0F	27	07	97
06E0	06	81	08	27	04	39	7F	00	06	D6	1E	C1	00	27	34	81
06F0	08	27	F2	96	07	4C	97	07	DE	39	DF	55	7F	00	39	7F
0700	00	3A	81	3C	27	2F	D6	1C	C5	10	26	07	84	07	81	07
0710	27	01	39	DE	3B	DF	5E	DE	2F	DF	5C	CE	00	00	DF	3B
0720	DF	2F	39	D6	2C	81	08	27	06	C4	7F	D7	2C	20	C0	CA
0730	80	D7	2C	20	BA	7F	00	07	CE	00	05	A6	00	8D	01	39
0740	81	59	27	06	8B	01	19	A7	00	39	6F	00	09	A6	00	20
0750	F3	CE	00	2D	Ä6	00	81	7E	27	0E	81	FE	27	0A	81	80
0760	27	06	81	00	27	02	20	0C	84	80	A7	00	09	8C	00	2A
0770	27	F4	20	E0	86	00	B7	80	04	96	22	DE	24	B7	80	06
0780	D6	59	C1	00	26	0B	D6	54	C1	00	26	05	B1	80	06	26
0790	28	E6	00	F7	80	04	08	8C	00	2F	27	07	48	DF	24	97
07A0	22	20	09	CE	00	2A	86	08	DF	24	97	22	96	59	81	00
07B0	20	01	3B	B6	80	06	97	5A	3B	B6	80	06	97	54	96	22
07C0	97	23	3B	8E	00	7F	7F	00	2E	7F	00	54	86	08	97	22
07D0	97	23	CE	00	2A	DF	24	7F	00	59	CE	00	00	DF	5C	DF
07E0	5E	DF	2F	DF	55	DF	3B	DF	39	DF	31	DF	35	DF	52	DF
07F0	5A	7E	60	W0	FF	FF	FF	FF	66	1F	FF	FF	67	51	67	C3



**YOUR
★ BONUS-★**

JAYCAR QUALITY FOR NO MORE *

500MHz Digital Frequency Period Meter

REF: EA Dec '81 — Feb '82

NOW BACK IN STOCK! The best version of this kit in Australia is now back in stock. Why settle for an inferior kit at the same price as ours?

500MHz option only \$26 extra
50MHz Version \$119



Tilting Bail to suit ONLY \$4.95

Other people may appear to be selling this kit for less. But you GET less!! Exclusive Jaycar features:

- * Heavy gauge front panel. Pre-punched, and silk screened. (NOT Scotchcal). * Low aging rate 10,000 MHz crystal * Quality IC sockets provided (A MUST)
- * All metal film resistors used (1% 50ppm) * Therm-alloy heatsink for +5V regulator

Beware of advertised units that do not conform to the original design. They may have inferior performance.



THE BEST
QUALITY
KIT
VERSION
OF THIS
PROJECT
IN
AUSTRALIA

Lyrebird Piano Kit REF: EA 11/81-1/82 NEW LOW PRICE ...

\$475

SAVE \$50!!!



BOTH
PIANO KITS
FEATURE I.C.
SOCKETS PROVIDED
AT NO EXTRA
CHARGE!!!

7½ OCTAVE (88 NOTE)
VERSIONS \$589

* Stand \$75 extra

Because we are shipping keyboards and other expensive components in bulk due to high demand, we can pass savings onto YOU. You can now have a magnificent "Lyrebird" six octave touch sensitive piano for only \$475!! That's a staggering \$50 off the old price. REMEMBER!! THE LYREBIRD OUTPERFORMS READY BUILT PIANOS COSTING UP TO THOUSANDS OF DOLLARS MORE. WHY PAY MORE WHEN YOUR CONSTRUCTION KNOWLEDGE CAN SAVE YOU A FORTUNE?

syntom

Original design from the UK magazine "Electronics and Music Maker" April 1981. Self-contained unit produces a variety of fixed and falling pitch effects. Triggered by tapping the unit itself or by striking a drum to which a contact is attached. The Jaycar "SYNTOM" comes complete with high quality pre-drilled moulded all ABS box 152 x 80 x 47mm with professional silk screened front panel.

FEATURES Decay from less than 0.1 second to several seconds, pitch control, sweep control and volume on/off.

Only \$3250
THIS MONTH ONLY!! SAVE \$4.00



As used
by
Warren
Cann
of
'Ultravox'

GOOD-BYE 3002

This 2x300WRMS P.A. Head is a classic road amp. Ruggedly constructed, 19" rack mount makes an ideal main P.A. or foldback unit. Great for Disco use as well.

We are discontinuing this amp because it is becoming too expensive to make. The metalwork costs alone now account for well over 50% of the unit. Because of this we have reluctantly decided to discontinue the unit.

You can grab one now while they last for only \$399

\$489 \$399

SAVE \$89!!!



Send SAE for full spec. sheet.

JAYCAR DEALER: G&J Electric, Forresters Beach NSW 2260 Ph: (043) 845787

1/3 OCTAVE 28 BAND EQUALISER

The 2801 is a single channel graphic equaliser that divides the audio spectrum into twenty eight one third octave bands. Each frequency segment is controlled by a slider that provides up to -10dB of adjustment in standard ISO steps. The 2801 was designed primarily to compensate for any deficiencies in the linearity of speaker systems, acoustic peculiarities of the hall or listening room, and inadequacies of program source quality.

In P.A. application the equaliser may be used to improve sound quality and increase intelligibility by attenuating problem frequencies that cause ringing, boominess or other disruptive resonances that occur in acoustically difficult rooms. The 2801 allows sound systems to be "tuned" according to the special acoustics of a room, to maximize output and minimize feedback.

As a creative tool in sound recording or re-recording the 2801 allows complete freedom in contouring response over the complete audio spectrum from 31.5Hz to 16KHz.

TOTALLY REFURBISHED MODEL—2801 MKII A

This model is distinct from the 2801, 2801 MK II. It features quality I.C. sockets for all I.C.'s as well as several component changes. i.e.: We are using 4136 op amps again because they draw less current than the TLO75/85. This results in less hum radiation from the transformer. We are also using higher value slide pots, and a 5534 op amp for the line driver. Using the 5534 renders the output short circuit proof handy when on the road.

You get all these great new features at no extra cost!

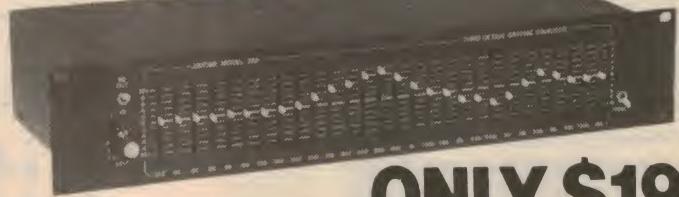
NEW MkII model A

SPECIFICATIONS

DISTORTION	Less than .04% 20Hz-20KHz
FREQUENCY RESPONSE	Flat 20Hz-20KHz ±1dB
EQ. IN	Greater than 85dB
SIGNAL TO NOISE RATIO	50x to 100x depending on the input configuration
EQ. OUT CONTROLS	Flat 20Hz-20KHz ±1dB
OUTPUT IMPEDANCE	10 volts
MINIMUM INPUT	31.5, 40, 50, 63, 80, 100, 120, 160, 200, 250, 319
VOLTAGE	100, 120, 160, 200, 250, 319
EQ centre frequencies	3.15K, 4K, 5K, 6.3K, 8K, 10K, 12.5K, 16K, 25K,
Range of controls	+10dB
Individual Filters	+15dB
LEVEL	28 Vertical potentiometers continuously variable
EQ BYPASS	+10dB
POWER	Rotary potentiometer variable +15dB
Terminations	Toggle switch
PHYSICAL	Toggle switch
Size	Rear panel RCA sockets and 6.5mm sockets for
Weight	input and output
Finish	19" x 3½" x 8" (standard rack mount size)

Front panel brushed and anodized black with lettering, black Marviplate cover.

NEW
ALL I.C.
SOCKETS AT NO
EXTRA CHARGE!



ONLY \$198

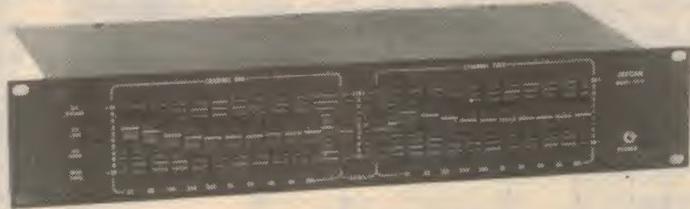
SPECIFICATIONS

ELECTRICAL (EACH CHANNEL)	
F.Q. LINE OR TAPE	±0.5dB 10Hz to 20kHz, Controls flat
SIGNAL TO NOISE RATIO	Flat
2 VOLTS OUT CONTROLS FLAT	Less than .04% 20Hz to 20KHz
TOUCH SCREEN GROUND	100x to 1000x
2 VOLTS OUT CONTROLS FLAT	2 Volts RMS into 10k load
OUTPUT IMPEDANCE	10 volts RMS
INPUT IMPEDANCE	50K normal
INPUT IMPEDANCE	10 volts RMS
EQ CENTRE FREQUENCIES	31, 62, 125, 500, 1K, 2K, 4K, 8K, Hz ±10%
RANGE OF CONTROLS	+12 dB at Centre Frequency
INDIVIDUAL FILTERS	+10dB
LEVEL SWITCH	10 Vertical Slide Controls for each channel
CONTROLS	Vertical Slide Control each Channel
EQ CENTRE FREQUENCIES	Pushbutton Switch
EQ BYPASS	Pushbutton Switch
POWER	Pushbutton Switch
TERMINATIONS	Pushbutton Switch
PHYSICAL DIMENSIONS	Pushbutton Switch with LED
WEIGHT	Indicator
FINISH	Rear panel RCA sockets for both input and output connections

483mm x 59mm x 152mm
(19" x 3½" x 8")
4kg
Front panel brushed and anodized
Aluminum silk screened lettering,
Black Marviplate covers.

JAYCAR 2010 EQUALISER

The 2010 is a two channel graphic equaliser featuring ten adjustable controls on octave centre frequencies (independent for each channel). Each control provides up to +14dB of adjustment. Each channel is also equipped with a level match control giving an overall gain of adjustment of +14dB. The functional versatility of the 2010 equaliser is unsurpassed. Eight modes of operation are available from the push button switches on the front panel. Included amongst these are the ability to equalise both recording and playback when dubbing tapes. The 2010 has been designed to be compatible with all commercially available equipment and is ideal for use in a Hi Fi system or PA system



ONLY \$129

NEW MkII model A with QUAD-FETs

EXCLUSIVE!!! ALL JAYCAR TEST EQUIPMENT KITS ARE PROVIDED WITH QUALITY I.C. SOCKETS AT NO EXTRA CHARGE!!!

Digital EA2/82 Thermometer



Ret: EA Feb 1982
Read the temperature in your room (or outside) from 0 degrees C to 100 degrees C in fact to with in 0.1 degree C. Fantastic resolution on a bright easy-to-read display.
INC CASE

\$69

EA dual tracking P/S



EXCLUSIVE!!
US MADE
10 TURN 25%
LINEARITY POT
used for greater
accuracy

\$84.50

1% resistors used NOT 2%.
At last!! A dual-tracking power supply with fixed +5V reg. at a reasonable price!!

YOU PAY NO MORE FOR A QUALITY JAYCAR KIT!!

DIGITAL CAPACITANCE METER

Ref: EA March 1982
This kit once again uses the amazing DPM 200 LCD display/driver module Capable of measuring capacitance from: 1pF to 19.99uF. It is a must in every workshop or lab.



\$69

HEART RATE MONITOR

Ref: EA 7/82
NOW \$69
WAS \$79 SAVE \$10
This unit enables you to measure your own pulse instantly and accurately. It is light enough even for joggers to carry. A must for people who may have heart problems. Complete kit including LCD Display.



Digital Storage CRO Adaptor

Ref: EA March 1982
Not only can you avoid buying an expensive CRO but you can have the features of the REALLY expensive ones!!!



Can display very slow waveforms
One shot triggering
Inbuilt graticule shows on TV screen
Crystal locked timebase

DC 100kHz bandwidth
capable of storage operation
Staggering value at \$110.

\$110

NEW!!! LCD TACHO KIT!

ref:
EA May 1982

\$49.50

USES NEW DPM-05 DISPLAY
FITS INTO YOUR DASHBOARD
RPM, DWELL DISPLAY

JAYCAR

125 YORK ST SYDNEY 2000

Ph. 2646688 Telex: 72293

Mail Orders To:

Box K-39 Haymarket 2000

POST AND PACKING CHARGE:
\$5-\$9.99 \$1.20 \$10-\$24.99 \$2.40
\$2-\$49.99 \$3.50 \$50-\$99.99 \$4.60

NEW SHOP HOURS
Mon-Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

\$100 up \$6.20

Circuit & Design Ideas

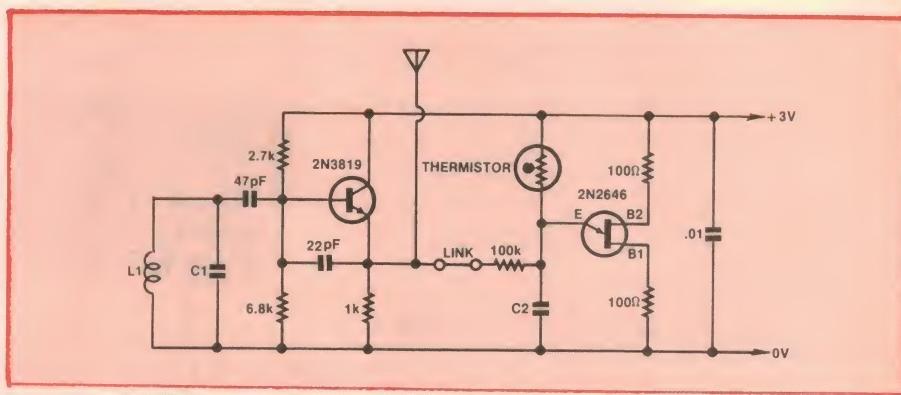
Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

Bugging a lizard on the FM broadcast band

The circuit shown was developed as an animal (lizard in this case) tracking transmitter, with a temperature information modulator. It operates in the FM broadcast band (88-108MHz).

The transmitter itself is built about the 2N3819 transistor and is a simple oscillator circuit with the frequency being determined by the tuned circuit L1, C1. Stray capacitances and inductances will also effect the output frequency and the effect of these is minimised by careful construction and keeping component leads as short as possible.

Resistors must be carbon or metal film type — wire wound types will act as inductors. Capacitors must be low loss, sub-miniature, plate ceramic types. The aerial was a 50cm length of extra flexible wire. Inductor L1 is three turns of 20g copper wire on a 6mm former, and C1



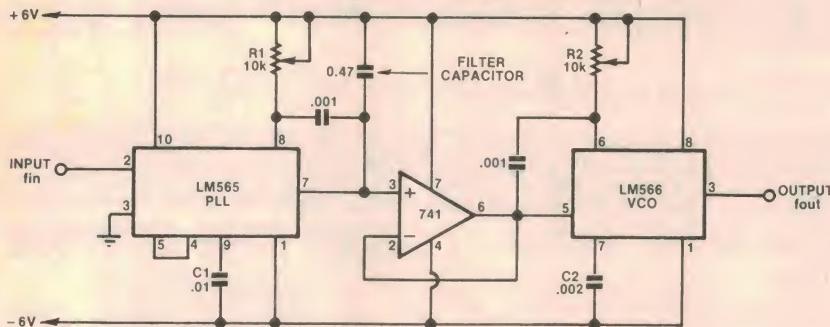
will be approximately seven to 15pF according to the layout and frequency required.

The temperature sensor/modulator is built around a 2N2646 unijunction wired as an audio frequency relaxation

oscillator. The thermistor (T) varies the audio frequency according to the temperature.

B. T. Hunt,
Papua New Guinea.

Fractional frequency multiplier



While most frequency multipliers using a phase-locked loop (PLL) can multiply frequencies only in exact integer amounts, this circuit can multiply by any real number, fractional or otherwise. It combines a phase-locked loop frequency-to-voltage converter and a separate voltage controlled oscillator.

The PLL is connected as a frequency demodulator and the demodulated output at pin 7 is fed to a 741 connected as

a voltage-follower. This drives the modulation input, pin 5, of the 566 voltage-controlled oscillator. The multiplication factor is determined by the formula $n = R1C1/R2C2$. For stable circuit operation, R1 and C1 should be selected to suit the input frequency while R2 and C2 are chosen to give the required multiplication factor.

From "Electronics",
May 19, 1982.

Refurbishing a radiator

Domestic single-bar radiators which have rusty and unsightly reflectors can be cheaply restored with the aid of aluminium foil. The foil should be placed over the reflector, underneath any protective grille and kept taut by

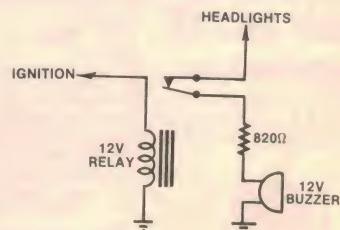
wedging it in the rolled edges of the reflector. Naturally the foil must be kept well clear of the radiator element itself and its active end terminations.

K. Kenneally,
Collaroy, NSW.

Remember the lights!

Oops! Guess what? You've left your car headlights on in the car and now the battery is flat. Ever wished you had something to remind you about those lights?

This circuit should do the job. Connect the lead labelled "Headlights" to the headlight fuse and the lead labelled



"Ignition" to the ignition circuit, or the fuse of any circuit which remains on only when the ignition is on.

Whilever the ignition is on, the relay is activated and the buzzer circuit is open. When the ignition is switched off the relay drops out, the circuit from the headlights to the buzzer is completed and, if the headlights are still on, the buzzer will sound.

The value of the resistor was selected so suit the buzzer, which operates at about 15mA. Its value can be varied to suit the buzzer used.

I. Chia,
St Kilda East, Vic.

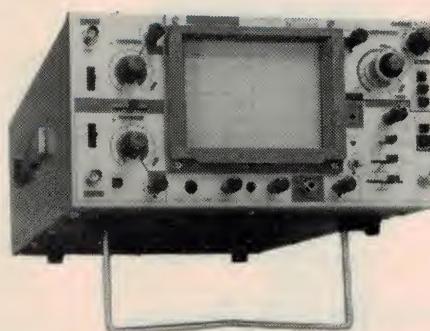
1982/8

POPULAR SCOPES & MULTIMETERS

45MHz / 1mV Model BS625 with Signal & Timebase Delay

ARON

- 150mm metal-backed PDA rectangular tube
- High 15kV accelerating voltage
- Channel A, Channel B, Dual, Chopped, Alternate switch selectable
- Channel B invert
- Fast 7.7nS risetime
- Single sweep
- Trigger delay
- TV sync
- Z modulation
- Variable graticule illumination
- Trace rotation
- X-Y operation
- Weighs only 9.8kg



CRT

6" (150mm) Flat-trace Metal-back Post-Deflection Accelerator with internal Graticule
Effective Display Area: 8 x 10div (1div = 10mm)
Acceleration potential: 15kV

VERTICAL

Operating Modes: CH-A, CH-B, DUAL, ADD and CHOP (CH-B can be inverted)
DUAL Modes: ALTER: 0.2μs-0.5ms/div
CHOP: 1ms-0.5s/div
CHOP Frequency 200KHz approx.

Deflection Factor:

5mV/div-5V/div
1mV/div-1V/div (5X GAIN),
12 ranges in 1-2-5 step with fine control.

Bandwidth:

NORM: DC : DC-45MHz (-3dB)
AC : 10Hz-45MHz (-3dB)

5X GAIN:

DC : DC-10MHz (-3dB)
AC : 10Hz-10MHz (-3dB)

Rise Time:

Less than 7.7ns (Less than 35ns with 5X GAIN)

Overshoot:

Less than 3%

Input Impedance:

1MΩ ±5%, 20pF ±3pF

Delay Time:

DELAY LINE 120ns (effective delay 20ns in display)

\$990.00

Maximum Input Voltage:

600V p-p or 300V p-p
(DC + AC p-p)

Better than 70dB at 1kHz.

Channel Isolation:

HORIZONTAL

Sweep Modes:

Time Base:

NORMAL, AUTO & SINGLE

0.2μs - 0.5s/div

20 Ranges in 1-2-5 step

with fine control

5 times (5X MAG)

3%

Sweep Magnifier:

Linearity:

TRIGGERING

Single Sweep:

Delayed Triggering:

Trigger Delay Time:

Delay Jitter:

Sensitivity:

Stand-by mode by push switch

LED Indication

INTEN'D: shows where

triggering starts with

intensity difference

DELAY'D: Triggering is

delayed to the point where

indicated by INTEN'D

100ms-1μs ± 20% in

5 ranges with vernier

Less than 1/5000

INT:

Better than 0.3div for DC-10MHz

Better than 1div for DC-40MHz

Better than 2div for DC-45MHz

Better than 1.5div for DC-10MHz

(vertical PULL 5X GAIN)

EXT:

Better than 50mVp-p for

DC-10MHz

Better than 0.2Vp-p for

DC-45MHz

Source:
Slope:

Coupling:

INT, CH-A, CH-B, LINE and EXT Positive & Negative, continuously variable with level control PULL AUTO for free-run
AC, HF-REJ and TV SYNC Vertical & Horizontal Sync Separator Circuitry allows any portion of complex TV video waveform to be synchronized and expanded for viewing TV-H(Line) and TV-V(Frame) are switched automatically by SWEEP TIME/DIV switch.
TV-V : 0.5s/div to 0.1ms/div
TV-H : 50μs/div to 0.2μs/div

X-Y OPERATION

CH-A : Y axis, CH-B : X axis Highest sensitivity : 1mV/div with frequency bandwidth DC - 1MHz

OTHER SPECIFICATIONS

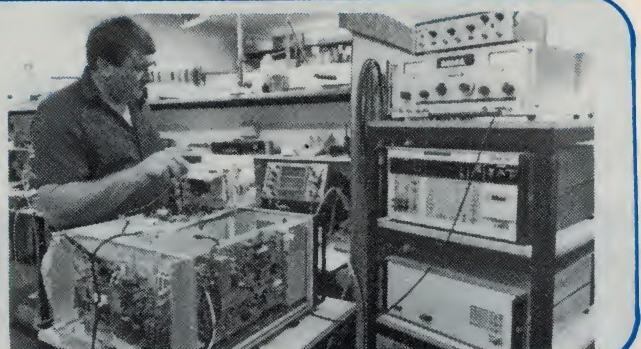
Intensity Modulation:
Positive ... brighter
Bandwidth : DC - 1MHz
Maximum Input Voltage : 50V (DC + ACp-p)
0.5Vp-p ± 5%, 1kHz ± 5%, Square wave
Calibration Voltage:
Trace Rotation:
Electrically adjustable on the front panel
Scale Illumination:
YES : Brightness variable
Power Requirements:
AC : 100, 120, 220, 240V ± 10%, 50/60Hz, 27W approx.
Weight
Size

9.8 kg approx.

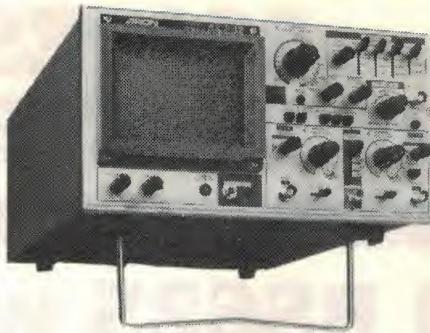
145(H) x 280(W) x 418(D) mm

Every instrument backed by Elmeasco

Elmeasco supports every instrument they manufacture or distribute. The Sydney Service Centre pictured is a NATA (National Association of Testing Authorities) approved laboratory.



35MHz / 1mV Model BS635



- Bright metal-backed rectangular CRT
- Delayed triggering
- Alternate triggering
- Single sweep
- Trigger hold-off
- Horizontal and vertical magnifiers
- Intensity modulation

\$790.00

ARON

CRT	6" (150 mm) Metal-back Post-Deflection-Accelerator with Internal Graticule	TRIGGERING Sensitivity	HORIZONTAL Sweep Modes	NORMAL, AUTO, SINGLE, and DELAY
Effective Display Area Acceleration potential	8 · 10div (1div = 10mm) 6KV		Time Base	0 1μs - 0.5s/div 21 ranges in 1-2-5 step with fine control
VERTICAL Operating Modes	CH-A, CH-B, DUAL, ADD and SUB (CH-B can be inverted) DUAL Modes ALTER 0.1μs ~ 0.5ms/div CHOP 1ms - 0.5s/div CHOP Frequency 200kHz approx 5mV/div -10V/div 1mV/div (5X GAIN) 11 ranges in 1-2-5 step with fine control	Source	Sweep Magnifier Linearity	5 times (5X MAG) 3%
Deflection Factor	NORM DC, DC - 35MHz (- 3 dB) AC, 10Hz - 35MHz (- 3 dB) 5X GAIN DC, DC - 10MHz (- 3 dB) AC, 10Hz - 10MHz (- 3 dB)	Slope	Delayed Trigger	INTEN'D; Delay time becomes dim DELAY D; Sweep starts at time delayed
Bandwidth	Less than 10ns (Less than 35ns with 5X GAIN) Less than 3%	Coupling	Delayed Time	100m/sec - 1μ/sec in 5 steps with variable
Rise Time	1MΩ · 5% 20pF · 3pF 600Vp-p or 300Vp-p (DC · ACp-p)	X-Y OPERATION	Delayed Jitter	1/5000
Overshoot	Better than 60 dB at 1kHz		Hold Off	10 times (Min to Max)
Input Impedance			OTHER SPECIFICATIONS	
Maximum Input Voltage			Intensity Modulation	TTL Level (3Vp-p); Positive.....
Channel Isolation			Calibration Voltage	Bandwidth DC - 1MHz
			Trace Rotation	Maximum Input Voltage 50V (DC · ACp-p)
			Power Requirements	0.5Vp-p · 5% 1kHz · 5%
			Weight	Square wave
			Size	Electrically adjustable on the front panel
				AC. 100, 120, 220, 240V · 10%, 50/60Hz, 30W approx.
				8kg approx
				162(H) · 294(W) · 352(D)mm

20MHz / 5mV Model BS601

WITH BUILT-IN COMPONENT TESTER AT NO EXTRA COST!!
Find faults faster... check component values... see characteristics on the screen.



VERTICAL Operating Modes	CH-A, CH-B DUAL ADD (CH-B can be inverted) DUAL Modes ALTER 0.5μs ~ 0.5ms/div CHOP 1ms - 0.5s/div CHOP Frequency 200kHz approx 5mV/div -10V/div · 3%	TRIGGERING Sensitivity	CRT	6" (150 mm) Flat-faced high-brightness CRT with Internal Graticule 8 · 10div (1div = 10mm) 2KV
Deflection Factor	11 ranges in 1-2-5 step with fine control	Source	COMPONENT TESTER	Max AC 9V at the terminal with no load Max current 2 mA when the terminal is shorted (Internal resistance is 4.7 kΩ)
Bandwidth	DC, DC - 20MHz (- 3 dB) AC, 10Hz - 20MHz (- 3 dB)	Slope	OTHER SPECIFICATIONS	TTL Level (3Vp-p), Positive.....
Rise Time	Less than 17ns	Coupling	Calibration Voltage	Bandwidth DC - 1MHz
Overshoot	Less than 3%		Trace Rotation	Maximum Input Voltage 50V (DC · ACp-p)
Input Impedance	1MΩ · 5% 20pF · 3pF		Power Requirements	0.5Vp-p · 5% 1kHz · 5%
Maximum Input Voltage	600Vp-p or 300Vp-p (DC · ACp-p)		Weight	Square wave
Channel Isolation	Better than 60 dB at 1kHz		Size	Electrically adjustable on the front panel
HORIZONTAL Sweep Modes	NORMAL, and AUTO			AC. 100, 120, 220, 240V 20W
Time Base	0.5μs - 0.5s/div · 3%			7kg approx
Sweep Magnifier Linearity	19 ranges in 1-2-5 step with fine control 5 times (5X MAG) 3%			162(H) · 294(W) · 352(D)mm
X-Y OPERATION	CH-A Y axis, CH-B X axis Highest sensitivity 5mV/div			

\$550.00

ARON

**ALL SCOPES HAVE MODERN RECTANGULAR CRT'S AND HAVE BEEN SELECTED FOR THEIR PRICE/PERFORMANCE SPECIFICATIONS.
Enquire about specialised scopes for your particular application.**

15MHz/2mV Model 310S

- 2 hour NiCad Battery operation
- Automatic recharging
- External dc operation
- High stability trigger circuit
- X-Y operation
- Auto-trigger free run
- TV sync
- Add-Subtract
- Ultra lightweight only 5.5kg

\$720.00

ATRON

H.D. Carry case \$55.00



VERTICAL DEFLECTION

Deflection Factor	2mVto10V/DIV on 12 ranges in 1-2-5 step with fine control
Bandwidth	DC : DC to 15MHz (-3dB) AC : 10Hz to 15MHz (-3dB)
Risetime	24nsec
Overshoot	Less than 3%
Input Impedance	1MΩ shunted by 20pF ± 3pF
Operating Modes	CH-A, CH-B, DUAL, ADD and CHOP
Chop Frequency	100kHz approx
Channel Separation	Better than 60dB at 1kHz
CH-B Polarity	CH-B can be inverted

TIME BASE

Type	Automatic and triggered
In automatic mode, sweep is obtained without input signal	0.5sec to 0.5sec/DIV on 19 ranges and X-Y in 1-2-5 step with fine control
Sweep Time	0.5sec/DIV to 0.1msec/DIV

TRIGGERING

x5 at all ranges

Less than 3%

Sensitivity

INT : 1 DIV or more

EXT : 1 Vp-p

INT, CH-A, CH-B or EXT

Positive and Negative, continuously variable level control : Pull for AUTO

20Hz to 15MHz

Range

Vertical and Horizontal Sync separator circuitry allows any portion of complex TV video waveform to be synchronized and expanded for viewing.

TV-H(Line) and TV-V(Frame) sync are switched automatically by SWEEP TIME/DIV switch

TV-V: 0.5sec/DIV to 0.1msec/DIV

TV-H: 50μsec/DIV to 0.5μsec/DIV

TV Sync

HORIZONTAL DEFLECTION

Deflection Factor 2mV to 10V/DIV on 12 ranges in 1-2-5 step with fine control

Frequency Response DC to 1MHz

Input Impedance 1MΩ shunted by 20pF + 3pF

Max Input Voltage 300V DC + AC peak or 600Vp-p

X-Y Operation X-Y mode is selected by SWEEP TIME/DIV switch

CH-A, Y axis CH-B: X axis

OTHER SPECIFICATIONS

CRT 95mm Rect(approx 1.5KV)

Calibration Voltage 0.5Vp-p ± 5%, 1kHz Sq Wave

Power Requirements AC 90-130V or 180-260V, 48-440Hz

DC 11-30V, 7.2VA

Battery Ni-Cad Battery (up to 2 hour operation)

Weight 5.5kg including battery

Size 113(H) 223(W) 298(D) mm



20MHz/2mV Model OS300

- Calibrated or variable sensitivity (to match other measurement units)
- Add/invert and X-Y operation
- Fast (50nS/cm) timebase with vernier
- TV trigger with "active" sync separator

\$695.00

GOULD

■ DISPLAY 8x10cm rectangular Mono-accelerator CRT at 2kV EHT with quick heat cathode. Trace Rotation by front panel preset.

■ VERTICAL DEFLECTION Two identical input channels CH1 and CH2 Bandwidth (-3dB): DC to 20MHz (2Hz to 20MHz on AC).

Sensitivity: 2mV/cm to 100V/cm in 1-2-5 sequence.

Accuracy: ±3%.

Variable Sensitivity: 2.5:1 range allows continuous adjustment of sensitivity from 2mV/cm to 25V/cm.

Input Impedance: 1MΩ/28pF.

Input Coupling: DC-GND-AC.

Input Protection: 400V DC or pk AC.

DISPLAY MODES

Single Trace:

CH1 or CH2.

Dual Trace:

Chopped or Alternate modes automatically selected by the T.B. switch changing between 0.5 and 0.2ms/cm.

Chop frequency 500kHz approximately.

Add:

CH1 and CH2 added to give the algebraic sum of the two channels.

Invert CH2:

CH2 may be inverted. When used in conjunction with Add mode it gives the algebraic difference of the two channels.

X-Y:

CH1 input gives X deflection and CH2 input gives Y deflection.

X-Y Bandwidth:

(-3dB): DC to 1MHz with less than 3° phase shift at 50kHz

HORIZONTAL DEFLECTION

Timebase: 0.5μs/cm to 0.2 sec/cm, t8 ranges in 1-2-5 sequence.

Accuracy: ±3%.

X Expansion: X10, accuracy ±3%. Fastest speed of 50ns/cm, accuracy ±5%.

Variable Sweep: Variable 1 range allows continuous coverage from 0.5μs/cm to 0.5 sec/cm.

■ TRIGGER Internal level control with Bright Line ON/OFF facility. With Bright Line ON, the timebase free-runs when insufficient signal (20Hz to 20MHz) is present or when the selected level is outside the range of the input signal.

Source: Internal CH1 or CH2, or External.

Slope:

+ve or -ve.

Coupling:

DC, AC or TV

NOTE: TV is active sync separator with line/frame selected by timebase with:-

Field Rate from 0.2sec/cm to 100μs/cm.

Line Rate from 50μs/cm to 0.5μs/cm.

Internal Sensitivity:

DC coupled 2mm to 2MHz,

5mm to 20MHz

AC coupled 2mm, 10Hz - 2MHz,

5mm, 4Hz - 20MHz.

External Sensitivity:

DC coupled 100mV to 2MHz,

400mV to 20MHz

AC coupled 100mV, 10Hz to 2MHz,

400mV, 4Hz - 20MHz

External Input Impedance:

100KΩ/10pF approximately.

External Input Protection:

250V RMS, 400V pk

ADDITIONAL FACILITIES

Calibrator:

1V ± 2% square wave at approximately 1KHz

Ramp Output:

Approximately ±3.5V ramp from 5kΩ

Z Mod. Input:

DC coupled, 2V visible mod. sensitivity, +40V cut off sensitivity, input impedance 10kΩ/10pF approximately.

■ SUPPLY

100V, 120V, 220V and 240V ±10%, 45 to 440Hz, approximately 40VA

■ SAFETY

Designed for IEC 348 Cat.t

■ TEMPERATURE RANGE

0 to +50°C (+15 to 35°C for full accuracy)

■ DIMENSIONS

140 x 305 x 460mm (5 1/2 x 12 x 18 1/2 inches)

■ WEIGHT

5.8kg (12lbs 12oz approx)

■ ACCESSORIES SUPPLIED

Supply Lead 402001

Handbook 402011

Accessories

SP100 Probe



This passive probe incorporates a three-position slide switch in the head and has a cable length of 1.5 metres.

Position x 1

Bandwidth 1MHz

Input Resistance 1MΩ

Input Capacity 40 pF

Working Voltage 600 Volts D.C.

(including Peak A.C.)

Cable Length 1.5 Metres

\$25.00

Position Ref. Probe tip grounded via 9MΩ resistor, oscilloscope input grounded

Position x 10

Bandwidth 3.5 nanoseconds

Input Resistance 10MΩ when used

with oscilloscopes which have 1MΩ

input (Probe resistance 9MΩ ± 1%)

11.5 pF when used with

oscilloscopes which have a 30pF

input capacity

10.60 pF

600 Volts D.C.

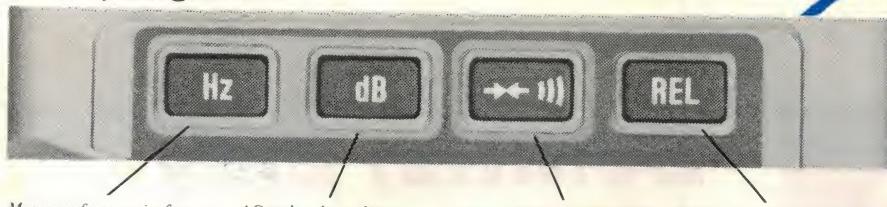
(including Peak A.C.)



NOW FLUKE INTRODUCES 4½ DIGIT HANDHELD 8060A WITH DB, FREQUENCY AND OFFSET.

- Two New 4½-Digit Handheld DMM's from Fluke
- Wideband True RMS AC Measurements (100 kHz-8060A, 30 kHz-8062A)
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- Frequency Measurement to 200 kHz, 0.01 Hz Resolution to 200 Hz, 1 Second Response Time (8060A only)
- dBm Referenced to 600 ohm (8060A only)
- Relative dB measurement (8060A only)
- Conductance (8060A only)
- Separate Constant Current Source Diode Test
- Self Diagnostics

FLUKE



Measures frequencies from 12 Hz to 200 kHz, fully auto-ranging, with 1-second response time and 0.01 Hz resolution to 200 Hz.

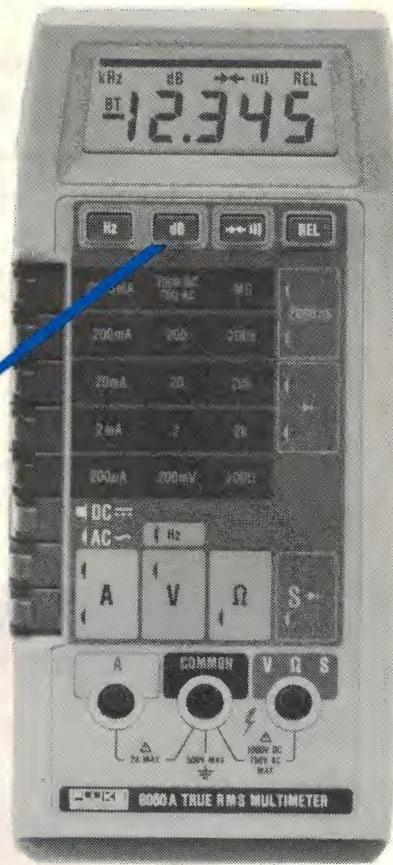
AC or dc voltage displayed in dBm referenced to 600 ohms, or relative dB.

Selectable visual (→↔) and audible (↔) indicators for high-speed continuity checking, 50 µS response time.

Relative reference (offset) feature works with all functions—including frequency and dB—to indicate ± deviations from stored inputs.

8060A \$398.00

8062A \$318.00



POPULAR 8020 SERIES MULTIMETERS

8020B \$219.00

- 0.1% basic accuracy, 3½ digit
- Improved version of the most popular DMM ever made!
- Eight functions including conductance and diode test
- Now with high speed beeper

8021B \$172.00

& 8022B \$162.00

- 0.25% Accuracy
- 3½ digits
- Extensive overload protection
- AC and DC Voltage and Current, Resistance and Diode Test
- High Speed audible continuity beeper (8021B Only)
- 8022B is Fluke's lowest price DMM

8024B \$275.00

- 11 functions including temperature with K-type thermocouples
- Peak hold on voltage and current ranges
- Logic detection and continuity measurements
- 0.1% basic accuracy, 3½ digit
- Audible and visible indicators

Selection Guide

	DC Voltage	AC Voltage	AC Current	Resistance	Diode Test	Conductance	Continuity	Logic Level	Temperature	Peak Hold	DC Accuracy	
8022B	•	•	•	•	•	•	•	•	•	•	•	0.25%
8021B	•	•	•	•	•	•	•	•	•	•	•	0.25%
8020B	•	•	•	•	•	•	•	•	•	•	•	0.1%
8024B	•	•	•	•	•	•	•	•	•	•	•	0.1%

	4½-Digit Resolution	Wideband True RMS AC	Continuity/Audible & Visual	dBm, Relative dB	Relative Reference (Offset)	Frequency	Autoranging Measurements	Conductance	Constant Current Diode Test	Basic DC Accuracy
8060A	•	100 kHz	•	•	200 kHz	•	•	•	•	0.04%
8062A	•	30 kHz	•	•	•	•	•	•	•	0.05%

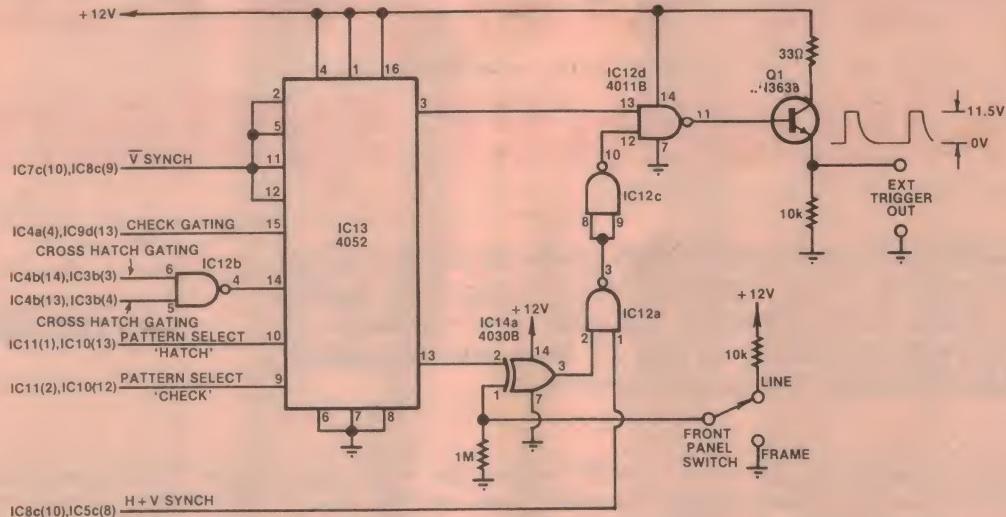
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P.O. Box 30, Concord, NSW. 2137
13-15 McDonald St., Mortlake, NSW. 2137
Phone: (02) 736-2888, Telex: 25887

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21-23 Anthony Drive, Mt. Waverley, Vic. 3149
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CRO trigger for the EA TV pattern generator



If you want to team the "Electronics Australia" TV Pattern Generator (June 1980) with a triggered CRO to make an effective fault-finding combination, try adding a CRO trigger signal output to the Pattern Generator. Using only three extra integrated circuits and a transistor connected as shown, a steady CRO trace locked either to the frame or line scan can be selected. Triggering becomes independent of the TV waveform being probed, so time and phase relationships can be examined without recourse to an expensive dual beam CRO.

The prototype was constructed as an outrigger board connected via a short length of rainbow cable to the main Pattern Generator board. Space inside the original case was more than adequate and the existing power supply can easily cope with the slight extra power demand. One extra switch, for line/frame selection, is fitted to the front panel.

Functioning of the circuit is as follows: composite horizontal and vertical sync pulses are fed to IC12a pin 1. From here they go via inverter IC12c to IC12d, pin 12, and then to the base of Q1. Trigger pulses are taken from the collector of Q1.

These pulses are gated by signals on IC12a pin 2 and IC12d pin 13. IC14a provides either normal or complementary gating pulses depending on the position of the front panel "line/frame" selector switch.

Thus, in the "line" position, as shown, vertical pulses from IC7c, pin 10, on the main board, and which ultimately appear at pin 2 of IC14a, will appear as

complementary pulses at pin 2 of IC12a, gating it off during the vertical sync pulse period, and leaving only line pulses to pass to Q1.

Conversely, when in the "frame" position, IC12a will be gated off between vertical pulses, so that only frame pulses pass to Q1.

At the same time a number of other functions are performed by IC13. This is a twin decoded, one-out-of-four, analog switch. It contains two groups of four switches which can be turned on in various combinations, according to the state of pins 9 and 10. Four conditions are possible; both pins low, pin 9 only high, pin 10 only high, and both pins high. Only three combinations are used, under the control of inputs from pattern

selector IC11 on the main Pattern Generator board.

Electronic selection of either "line" or "frame" triggering pulses is provided from the front panel toggle switch whenever the "white", "dot" or "grey scale" patterns are in use. Line synchronising pulses are suppressed during the frame blanking-retrace period to provide an unambiguous CRO display. Line synchronised triggering only is available for "checkerboard" and "crosshatch".

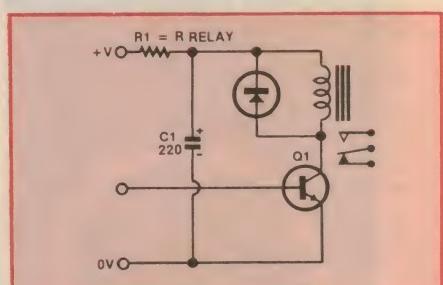
Finally a word of caution; remember to disconnect the soldering iron from the power mains and take precautions against static discharge when adding the outrigger to the existing CMOS circuitry.

R. Beaumont,
Pennant Hills, NSW.

Relay power saver

Have you ever had the problem that you need a relay for a project, and the only one you have is unsuitable? Either it is designed for intermittent use only, and overheats if it is on for more than a few minutes, or it uses too much power. If you try simply adding a series resistor, the relay may not turn on reliably.

While not new, this simple circuit overcomes these problems by the addition of an electrolytic capacitor able to store enough power to trip the relay. It is based on the principle that the current needed to keep a relay on once tripped is only about half the current required to trip it in the first place. R1 reduces the current to half (and the power dissipation in the relay to a quarter), while C1



stores charge during the relay off period. When Q1 is turned on, C1 discharges through Q1 and the relay, providing enough of a boost to get the contacts closed. In practice, the value of C1 may need some adjustment for the relay used.

S. Gagen,
North Balwyn, Vic.

A high-quality bookshelf system

Audax 'Compact 200' loudspeaker system

Many keen audiophiles do not have much space for a pair of large loudspeaker systems. This "Compact 200" using high quality drivers from Audax is an attractive solution. The enclosure is bookshelf-sized with a capacity of just 17 litres but the system has reasonable efficiency and power handling.

Audax is a name in loudspeakers that many hifi fans will be unaware of, partly because they are manufactured in France. But if we mention such well-known and respected loudspeaker names as KEF, Spendor, Mission and Chartwell, they are certain to ring a responsive chord. All these respected manufacturers, and quite a few others emanating from England and the USA, do in fact use drivers made by Audax. It is no secret.

Audax, in fact, is a major European manufacturer of loudspeakers with a production level of some 30,000 units per day from five factories. Half of this production is exported, chiefly to England, the USA and Scandinavia.

As a look through the current 297-page Audax catalogue will quickly show, Audax manufacture a staggering range of high fidelity drivers. We counted 140 different types in all, although variants of different models would probably greatly add to this total.

When we were approached by the local distributors for Audax, their suggestion for a compact bookshelf system was very attractive. This sector of the market has been largely neglected as far as the hobbyist is concerned and the opportunity to publish a system based on high quality drivers and designed along the lines set out by Thiele and Small seemed a good one.

In due course, we were presented with

a pair of prototype enclosures which had been built to a design by the Audax principals in France along the lines mentioned above. The systems sounded very promising indeed. We decided to go ahead. Subsequently, final prototypes were produced and we now present them here.

Our listening tests indicate that the Audax Compact 200s compare very favourably with our large reference 3-way systems in terms of general balance and overall sensitivity. The frequency response is really quite smooth over the whole audio range. Naturally, the response does taper at the high end above 15kHz and at the low end below about 80Hz. We found a small amount of bass boost desirable for listening to most types of music. With that proviso, these Audax systems are capable of very satisfying reproduction.

Specifications

For anyone familiar with the principles of Thiele and Small, as outlined in our series of articles on "Vented Loudspeaker Systems" in August, September and December, 1981, the



Two views of the Audax Compact 200 loudspeaker system, with and without grille cloth. Note that the white ring around the woofer is not as visible through the grille cloth as our photograph shows.

Audax Compact 200 system will be seen as about the smallest practical sealed enclosure for the woofer size used. Not only does the woofer diameter put a physical limit on the size of front baffle but the cone area and its compliance limit the volume.

The woofer has a nominal diameter of 200mm, hence the name of the system, "Compact 200". The type number of the woofer is almost as long as your arm, HD20B25J4C9, but each of those numbers and letters mean something to the French. First of all, "HD" presumably means high definition or something like that to indicate the quality of the unit.

"20B" refers to the nominal diameter in centimetres and the fact that the cone is made from Bextrene. "25J" refers to the voice coil diameter in millimetres with the J indicating a magnet diameter of 84mm. Finally, "4C9" refers to a 4-layer voice coil which is 9mm long.

Putting all the codification aside, the woofer is a typical modern high compliance design. It has a deep rubber roll surround and an effective cone diameter of about 150mm. It has a free-air resonance of about 27Hz and the figure for total Q is 0.57. The chassis is of pressed steel and has four flexible mounting lugs outside the main perimeter, to avoid distortion of the frame when mounting.

For those interested in producing their own enclosure design with this woofer, the calculated equivalent volume, or V_{as} , is 96 litres. The 3dB corner frequency in this sealed enclosure design is 62Hz and the sensitivity of the overall system is about average at 89dB (measured at one watt RMS and at one metre).

Matched to the woofer is a 25mm dome tweeter, again with a long type number, HD100D25HR, but we won't go through the same rigmarole in translation again. The unit has a faceplate 10cm in diameter with a protuberant dome. In our prototypes, the tweeters had a protective grille but they will not normally be supplied this way. Most commercial manufacturers apparently elect not to use the protective grille because it may have some prejudicial effect on the high frequency response.

Those readers who are concerned about the unprotected nature of the dome may be reassured to learn that, according to the Audax principals in Australia, there is a hard felt subdome assembly on the voice coil pole-piece. This prevents any serious and permanent distortion of the dome diaphragm in case it should be inadvertently bumped.

Resonant frequency of the tweeter dome is $900 \pm 100\text{Hz}$ and its nominal power handling is 30 watts.

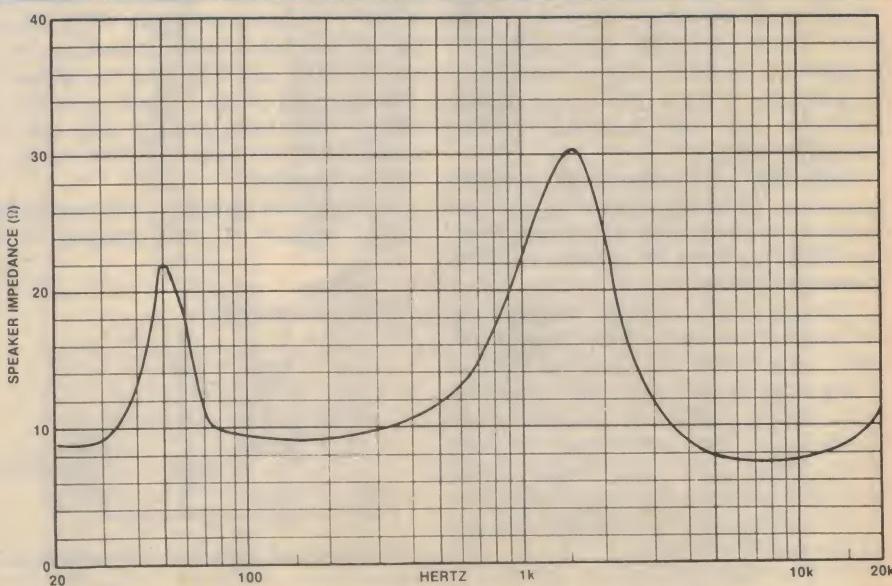
The crossover network is a relatively simple circuit mounted on a small printed circuit board. The crossover frequency is around 1.5kHz with the



The dome of the Audax HD100D25HR tweeter is a woven synthetic material. Note that the tweeters supplied will have a black anodised faceplate.

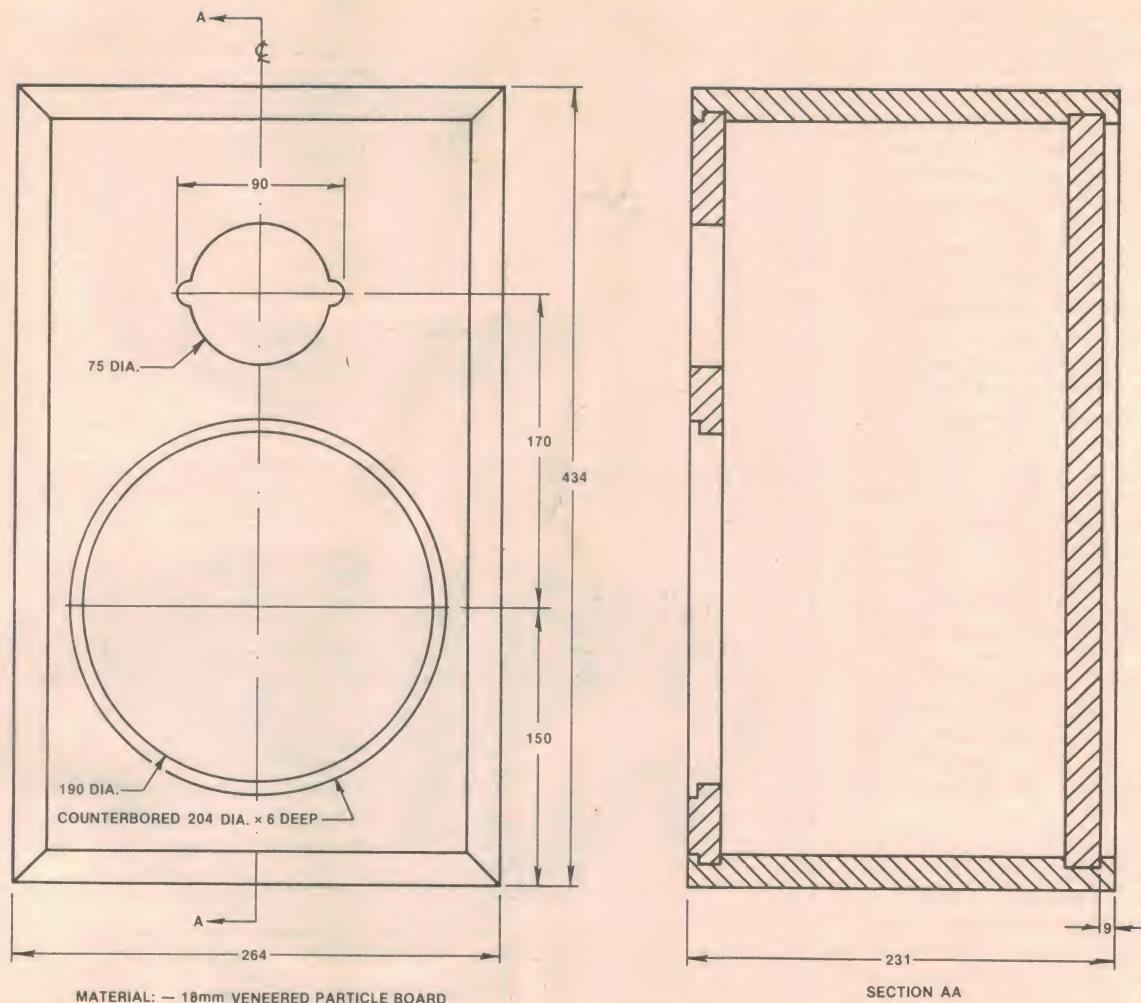


The Audax HD20B25J4C9 is a nominal 200mm in diameter and has a curvilinear cone made of Bextrene. Audax drivers are used in quite a few well known European brands.



The large rise in the system impedance at 1.5kHz is due to the crossover network.

Audax Compact 200 loudspeaker system



The above diagram gives the major enclosure dimensions for those who wish to make their own. Note that the terminal panel hole is not shown in the rear panel. Sealing of all cabinet joins is most important.

tweeter input attenuated by a nominal 12dB/octave above this frequency. Note that, above resonance, the tweeter impedance is relatively flat so that inductance of the tweeter does not unduly affect the roll off provided by the crossover network.

Note that the crossover network causes a substantial peak in the impedance of the system at 1.5kHz but this should not present any problems to the driving amplifier.

Considering the power rating of the drivers and nature of the crossover network, Audax rate the Compact 200s as being suitable for use with amplifiers with power ratings up to around 40 watts RMS. That would not preclude their being used with higher rated amplifiers though. You would just have to be a little more circumspect in the use of the volume control.

The enclosure dimensions are 264 x 434 x 250mm (W x H x D) with the

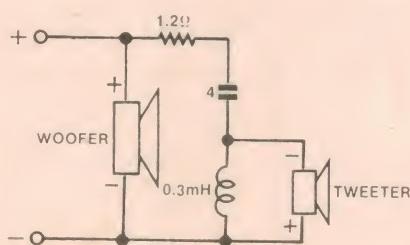
grille cloth frame attached. The rear panel is recessed by about 9mm which allows the enclosure to sit flush against a wall, without squashing the connections. The terminal panel is itself a recessed design with spring-loaded and colour-coded terminals (red and black) for bare wire connections.

As such, the Compact 200 would be highly suitable for wall hanging or it

could sit fairly unobtrusively on a shelf or in a wall unit.

The kit for this system will be presented in two parts which can be supplied separately if need be. The first part comprises two woofers, two tweeters, parts and printed circuit boards for two crossover networks and two connection terminal panels. The price of this is \$199. If buying by mail order, the cost of postage will be \$6, anywhere within Australia.

The second part of the kit comprises two loudspeaker boxes complete with grille frames. The boxes are fully assembled instead of being the more usual wrap-around fold-up assembly. We think that this is perhaps the principal attraction of the kit (apart from the obvious one of obtaining a first class compact system with European drivers). There is absolutely no woodwork to be performed so a first-class enclosure finish is assured.



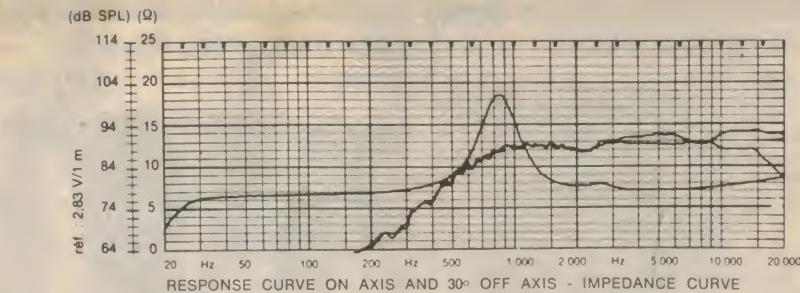
The three components in the crossover network are assembled onto a small PC board.

The enclosures are finished in vinyl veneer on four sides while the baffle is finished in black vinyl. The hole for the rear terminal panel is ready cut. Not supplied is the Innerbond filling. Enclosures with genuine wood veneer will be available on special order (and at extra cost).

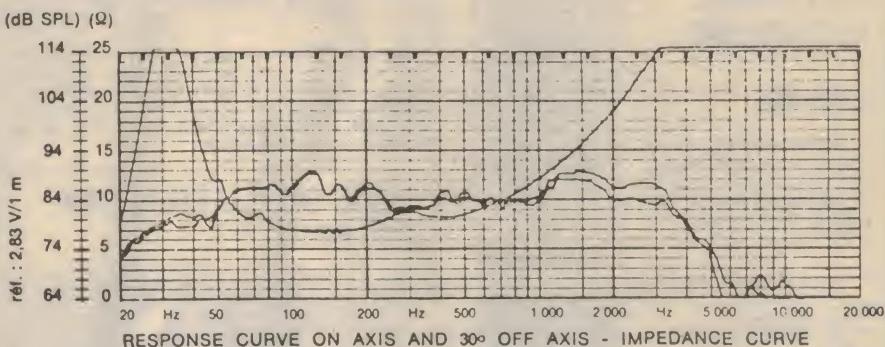
When despatched, the two completed boxes are stacked in the one carton. Price of this is \$99 which is a bargain. At this price there are probably very few constructors who will want to build their own cabinets. Cost of freight for the enclosures is \$15, anywhere in Australia.

Even though the large majority of constructors will probably go for the finished enclosures, we have produced a diagram with the major dimensions for those who wish to make their own. Note that the woofer is rebated into the baffle. If constructors do not have access to a router, the woofer may be mounted into an unrebated hole of the requisite diameter (190mm) and the mounting lugs spaced off the baffle by the thickness of one standard leather tap washer.

Since the enclosure material is 18mm thick chipboard and the panel sizes are fairly small, there should be no need for bracing. As with all enclosures though, they must be airtight. No leaks must occur, either at the cabinet joints or around the speakers or terminal panel. We recommend Engels No 5C draught exclu-



This plot shows the response curve of the tweeter on axis and 30° off axis and the impedance curve of the tweeter by itself.



This plot shows the response curve of the woofer on axis and 30° of axis when mounted on a flat baffle. Also shown is the impedance curve of the woofer itself.

sion tape to make gaskets for the woofer, tweeter and terminal panel.

Gaskets made up with this foam-backed adhesive tape have the advantage that they will seal again if the speakers ever have to be removed.

Install the rear terminal panel first with its gasket and then install the crossover network PC board. Then solder wires of different colours to the four crossover output connections and between the

(Continued on page 85)

AS FEATURED IN SEPT ELECTRONICS AUSTRALIA!



AUDAX

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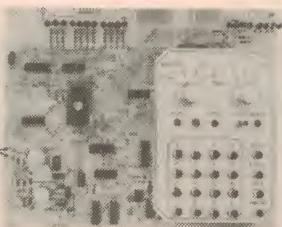
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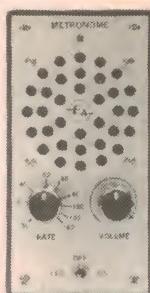
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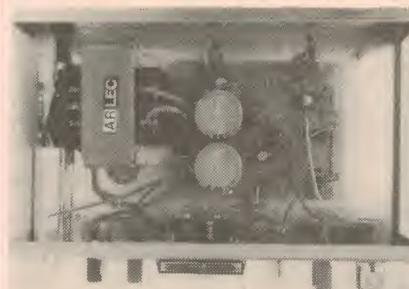
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Have great fun creating your own recording effects with music and voice. The Sound Bender can receive from Electric Guitar, Microphones, etc. ETI February 82



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Built around positive and negative 3-Terminal Regulators, this versatile dual tracking Power Supply can provide voltages from ±1.3V to ±22V at currents up to 2A. In addition, the Supply features a fixed +5V 0.9A output and is completely protected against short circuits, overloads and thermal runaway. EA March 82

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EA's great new Voice Operated Relay can be used to control a tape recorder, as a VOX circuit for a transmitter, or to control a slide projector. EA April 82

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\$79.50



This Function Generator with digital readout produces Sine, Triangle and Square waves over a frequency range from below 20Hz to above 160kHz with low distortion and good envelope stability. It has an inbuilt four-digit frequency counter for ease and accuracy of frequency setting. EA April 82

LOW OHMS METER

\$34.50

How many times have you cursed your Multimeter when you had to measure a low-value resistance. Well alas, with the "Low Ohms Meter" you can solve those old problems and in fact measure resistance from 100 Ohms down to 0.005 Ohms. ETI 158 November 81



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Catch those spectacular and humorous moments like that time your mother-in-law slipped on the moss covered patio and broke her neck. ETI 568 October 80



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Build a Led level Meter with simultaneous peak and average display plus 60dB dynamic range. This kit is ideal for any application requiring a wide dynamic range level display. ETI 458 June 81



LOTTO/POOL'S SELECTOR

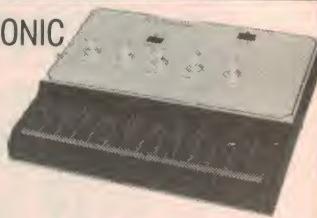
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You have to be in it to win it . . . Take the chance out of winning the Pools as well as Lotto, and build the great new Pools/Lotto Number Selector. EA July 81



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EA August 80

DIGITAL CAPACITANCE METER \$45.00



Here is an inexpensive Digital Capacitance Meter which measures from 1pF to 99.99μF in just three ranges. It's simple to use and features a big bright four-digit display with automatic updating and decimal points. EA March 80

ELECTRONIC DUMMY LOAD \$89.00

With this unit you can test power supplies at currents up to 15 Amps and Voltages up to 60 Volts. It can "sink" up to 200 Watts on a static test and you can modulate the load to perform dynamic tests. ETI 147 October 80



SELECTALOTT
\$22.00

"Who wants to be a millionaire . . .?" I do. "Selectalott" could help. It will select random numbers without superstition or bias . . . It could be you. EA December 80



PHOTON TORPEDO GAME

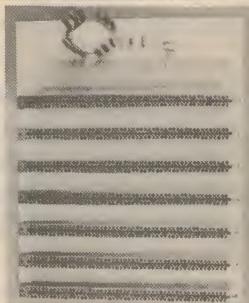
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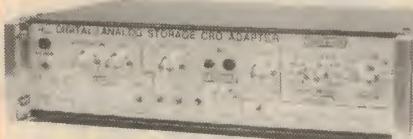
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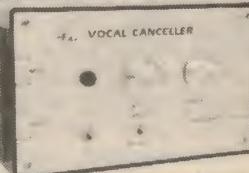
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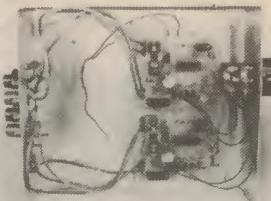
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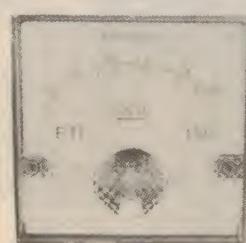
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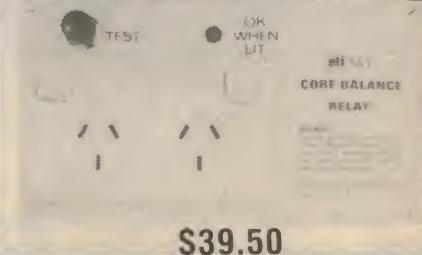
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Keep the cows out of the cabbages with this

ELECTRIC FENCE

Mains or battery powered, this electric fence controller is both inexpensive and versatile. Based on an automotive ignition coil, it should prove an adequate deterrent to all manner of livestock. Additionally, its operation conforms to the relevant clauses of Australian Standard 3129.

by COLIN DAWSON

Over the past few years we have received a steady stream of requests to describe an electric fence controller, plus a number of contributions to our "Circuit and Design Ideas" section describing such controllers. For a number of reasons — including legal ones, which we will deal with shortly — we have hesitated to publish these contributions, or offer a design of our own.

More recently, we received a CDI contribution from Mr R. Graham of Gerringong, NSW, describing a mains powered electric fence controller which he felt would interest our readers. Prompted by Mr Graham's suggestion, we took another look at the whole electric fence situation — including technical standards and legal obligations — and decided to publish a design, based partly on Mr Graham's, but modified to make it

suitable for either battery or mains operation, and checked to ensure that it comes within safety specifications.

Most readers will probably be aware of the broad concept of an electric fence. The power supply, or controller, is designed to apply a short high voltage impulse, at regular intervals, to a single bare wire supported by insulators on either existing fence posts or on temporary stakes driven into the ground. This type of deterrent is remarkably effective against even the most stubborn "fence breaking" animals and the fact that a temporary fence can be so effective is a very valuable aid to farmers wishing to control the grazing of their stock.

By far the most important single aspect of electric fence design and application is that of safety; there is not much point in



producing an effective fencing system if it carries a risk of killing or injuring either human beings or the animals it is intended to merely control. We cannot emphasise too strongly the need for extreme care and commonsense in all matters concerning electric fences.

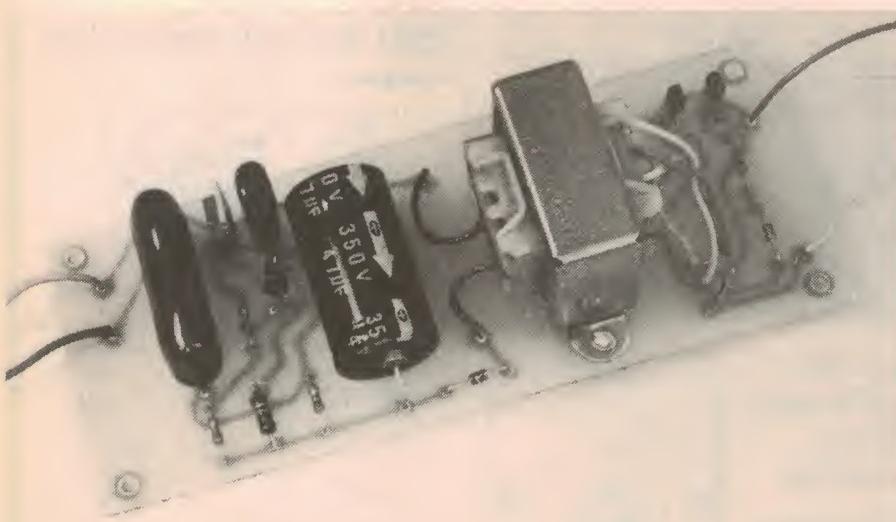
The safety aspect, and with it the legal responsibilities, can be best presented as two broad categories; the technical specifications of the equipment, which are designed to minimise any risk of injury in the event of accidental contact, and the application constraints and precautions which should be exercised to minimise the risk of accidental contact in the first place.

Design considerations

The technical aspect is really the simpler of the two, because adequate and quite stringent specifications have been laid down by the Standards Association of Australia as AS3129. These specifications are derived from the broad concept that regular short duration pulses are quite effective as an animal deterrent, but do not constitute the danger inherent in a continuously energised wire.

But this is not enough in itself. How long should these pulses be? How often should they occur? At what voltage and with what current capability? These, and similar questions, need to be answered specifically and this is the purpose of AS3129.

In detail, it sets out the following



The control circuit is built on a PC board and can be used with any standard automotive ignition coil. Unit can be either mains or battery operated.

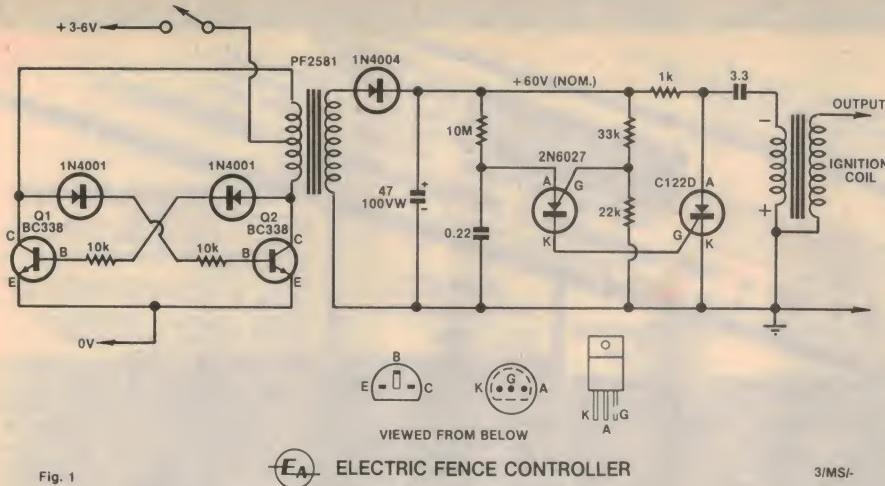


Fig. 1

ELECTRIC FENCE CONTROLLER

3/MSI-

The circuit diagram for the Electric Fence Controller. Note that the +60V rail is obtained with +6V into the inverter (with the PUT operating), and the ignition coil connected.

PARTS LIST

- 1 Printed circuit board, code 82ef9, 163 × 65mm
- 1 Transformer, 240V/12V centre tapped (PF2851 or equiv.)
- 1 Automotive ignition coil (see text)
- 1 Box to suit plus batteries as required

SEMICONDUCTORS

- 1 C122D silicon controlled rectifier (SCR)
- 1 2N6027 programmable unijunction transistor (PUT)
- 2 BC338 NPN transistors
- 1 1N4004 diode
- 2 1N4001 diodes

CAPACITORS

- 1 47μF/100VW electrolytic
- 1 3.3μF metallised polyester (greencap)
- 1 0.22μF greencap
- RESISTORS (1/4W, 5%)
- 1 × 10MΩ, 1 × 33kΩ, 1 × 22kΩ, 2 × 10kΩ, 1 × 1kΩ

MISCELLANEOUS

Copper-cored automotive ignition cable, screws, nuts, hook-up wire, insulators for fence, etc.

NOTE: components with ratings higher than specified may be used, provided they are physically compatible.

specifications and limits. The maximum output voltage, with a load impedance of $1\text{M}\Omega$, is 5kV. The pulse width must not exceed 0.1s, with a repetition rate of not less than 0.75s. Output current must not exceed 300mA for more than 0.3ms with a 500Ω load; current between pulses – not to exceed 0.7mA RMS with a 500Ω load; quantity of electricity – not to exceed 2.5mC with a 500Ω load. There are numerous other clauses relating to mechanical strength and accessibility of live parts, which would need to be consulted in order to build a unit to S.A.A. standards.

The unit which we are about to describe comes well within all these limits. For example, the voltage across a $1\text{M}\Omega$ load is around 2.5kV, the pulse length is a mere 3ms, and other values are similarly conservative. Yet it can still deliver quite a jolt, as two incautious EA staff members can confirm!

The second safety aspect, the manner in which the device is used, is not quite so easily defined, but must be considered nevertheless. First, it should be

realised that these devices are intended for use in rural areas where they will usually be set up well within the boundaries of private property and well away from public access. Even so, if there is a risk that members of the public may come in contact with it, AS3129 specifies that signs bearing the words "ELECTRIC FENCE" in letters not less than 50mm high, should be erected every 90m or less.

In no circumstances, for any reason whatsoever, should these devices be set up within the ordinary suburban domestic block. The risk of accidental contact, particularly by small children, is so much greater, that the possibility of injury becomes very real. It is not so much the actual shock which may be the danger, but rather the possibility of sometimes violent physical reaction which may injure either the victim, or someone standing nearby.

Significantly, some shire councils have banned the use of electric fences completely within their area and, equally significantly, some insurance companies

have stated that injury incurred by reason of an electric fence would not be covered by household liability insurance.

So much, then, for the legal and technical constraints which need to be observed in any operation involving an electric fence. Having clarified those aspects, let us look at the practical design.

Mains or battery power?

One of the first points to be decided in such a design is the source of power; batteries or mains. In some locations one may have little choice – mains power may simply not be available. It is one thing to have mains power at the homestead, but quite another at the other end of a 40 acre paddock. (Err, sorry; 16.19 hectare paddock.)

In such cases, battery power is the only answer, even though it is more expensive and usually less convenient. Then again, there is the question of which battery type to use. In the event, we decided to cater for all situations. Our controller can be built as a mains only device, a battery only device, or a combination unit which can be powered by either source, simply by connection to the appropriate leads. It can also operate from a range of battery types.

More exactly, we are describing a battery operated version as the basic unit, with the mains transformer as an "add-on" concept. Even if mains power is envisaged at the moment, we imagine a lot of readers would want to include the battery power supply anyway. It costs only about \$5.00 extra and greatly improves the versatility of the unit.

Battery operation is via an inverter which consists of a conventional free running multivibrator driving a 12V centre-tapped transformer. In this case, what is normally the secondary of the transformer is driven so that it has a step-up action. Each half of the centre-tapped winding provides the collector load for a BC338 NPN transistor. The base of each transistor is cross connected to the collector of the other via a $10\text{k}\Omega$ resistor and a diode. Due to slight differences in the transistors' operating characteristics and in the impedances of the transformer primary windings, one side of the multivibrator is activated first when power is applied.

As one transistor switches on – let us say Q1 – there is a rapid increase in current through the associated primary winding. This increase in current, by transformer action, produces a stepped up positive voltage at the Q2 collector end of the winding and this voltage is applied to the base of Q1 to turn it on still harder. Eventually, due to magnetic saturation and other factors, the current ceases to rise, transformer action ceases, Q1 is no longer biased on and it switches off. When this happens the collector

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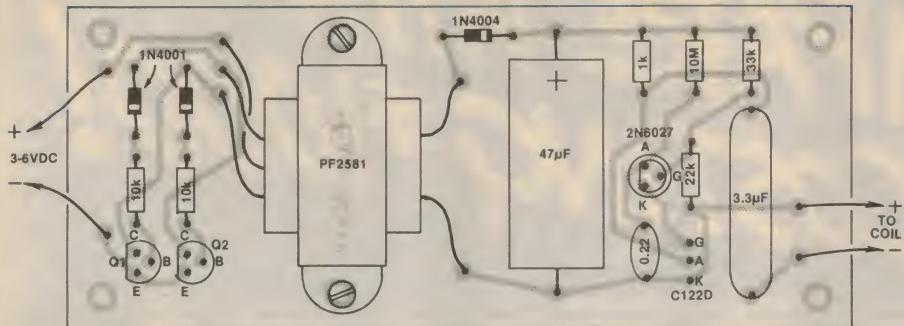
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Parts overlay diagram for the control circuit. For mains-powered operation, delete the inverter circuit and substitute a 240V/12V transformer (see text).

voltage of Q1 rises and biases on the base of Q2. Current then rises in the other half of the primary winding, and the whole cycle is repeated.

These oscillations in the primary windings (at about 25kHz) cause about 60V to appear across the secondary winding. This voltage is fed to a half wave rectifier with a $47\mu F$ filter capacitor. This capacitor stores sufficient charge for a number of discharge cycles. As a result, the discharge circuitry can continue to function (with decreasing power) for some time after the power is switched off. This should not be a problem, provided that you are aware of it.

This rectified voltage charges a $3.3\mu F$ metallised polyester capacitor, via a $1k\Omega$ resistor. This is the discharge capacitor – it cannot be an electrolytic type as they are not capable of the discharge rate required. This capacitor is connected in series with the primary of an automotive ignition coil via an SCR.

A 2N6027 programmable unijunction transistor (PUT) initiates a discharge cycle by supplying a brief pulse to the gate of the SCR. This causes the SCR to turn on, discharging the capacitor through the coil. The SCR will remain on until the discharge current falls below its "hold-on" current.

The rate at which the PUT supplies trigger pulses to the SCR depends on two factors – a reference voltage set on its own gate by the ratio of the $33k\Omega$ and the $22k\Omega$ resistors and the time constant of the $10M\Omega$ resistor and the $0.22\mu F$ capacitor. When the $0.22\mu F$ capacitor – and hence the PUT's anode – reaches a voltage 0.6V higher than the reference voltage the device switches on. This allows the $0.22\mu F$ capacitor to discharge into the gate of the SCR, thereby supplying a trigger pulse.

From the foregoing it is apparent that, to alter the trigger rate, we simply change this time constant. Increasing the value of either the $10M\Omega$ resistor or the $0.22\mu F$ capacitor will increase the time constant, and vice versa. With the values

shown the trigger rate is about 1s.

As indicated on the circuit, the inverter will operate from between three to six volts. In fact it will work quite well from two "D" size cells and could energise a small fence quite effectively in an emergency. Current consumption is quite reasonable, being a fraction under 20mA at 3V and around 45mA at 6V. (These figures as measured on our prototype.)

Even so, we don't recommend regular use from dry cells, particularly if the system has to run for long periods – 12 to 24 hours – continuously. If dry cells are contemplated for 6V operation, we suggest something like a lantern battery. Long term, a small accumulator, such as a motorcycle type, or even a set of nickel cadmium cells, "D" size, 2Ah to 4Ah, would be a much better proposition.

For mains operation the whole of the inverter circuit up to, but not including, the 1N4004 diode may be omitted. In its place we use a small power transformer delivering about 40V to the diode. This transformer must meet the relevant

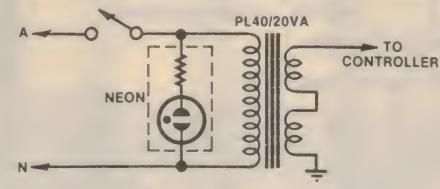


Fig. 2: This simple circuit lets you power the controller from the mains.

We estimate the current cost of components for this project to be approximately

\$15

This does not include a suitable case, 40V mains transformer or ignition coil.

clauses of Australian Standard C126 and the Ferguson PL40/20VA is the recommended choice. The few simple connections are shown in Fig 2, the active side of the transformer secondary going to the 1N4004 diode.

To make a combined battery/mains unit, simply fit a second diode between the transformer secondary lead and the positive terminal of the $47\mu F$ capacitor. Each diode will then effectively isolate each power supply from the other, and no switching is required.

Construction

To begin construction, mount the PC board components. We are assuming that most constructors will include the inverter. If this is not the case, simply delete the inverter components, including the step-up transformer. Mount the resistors first, then – taking care with their polarity – the semiconductors. Also note the polarity of the electrolytic when mounting it. Lastly, mount the inverter transformer, fastening it with a pair of screws and nuts. To connect the PC board to the coil, use automotive type hook-up wire.

Any standard automotive ignition coil, either a 7V or 12V type, may be used. You could purchase one for less than \$10 from K-mart stores or pick up a secondhand one from a wrecker's yard.

Next, it will be necessary to terminate the two high tension leads. If you can acquire a pre-terminated coil-to-distributor lead, this should prove ideal for the coil output. Otherwise, it will be necessary to fit a boot type connector yourself, since the coil output terminal is not adaptable to any other type of connector. The other lead requires a lug which fits the coil earth terminal. Both leads will need a heavy duty clip fitted to their free end.

To test the unit, position the output clips about a millimetre from each other and (with your hands clear of the leads) switch the power on. Within a few seconds, a spark should jump between the clips about once every second. If the inverter is working properly, there will be 30 to 60V across the $47\mu F$ filter capacitor. A properly functioning discharge circuit will cause a faint click in the coil with each discharge. Remember that the circuit will continue to discharge for some time after the power is switched off.

A suitable box to house the project will depend on the type of power supply used. For mains powered units, it is necessary to use a metal box so that it can be effectively earthed. Note that all leads should pass through grommetted holes and be anchored inside the case. The box should be weather-proof and

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Cat K-3520. See EA April 82

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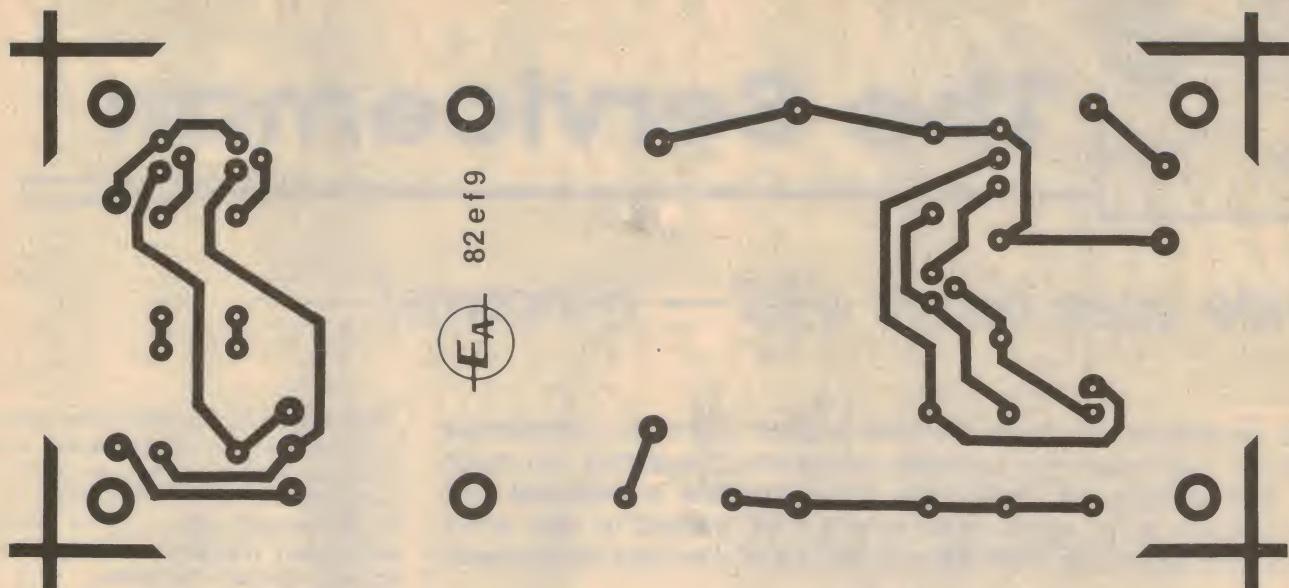
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DSE A326/PAL



Actual size artwork for the PC board. Finished boards are available from the usual retailers.

have the words "Electric Fence" clearly marked on it.

The coil is connected to the fence via the two lengths of ignition lead already mentioned. One connects the coil to the fence wire and the other connects to a metal stake driven into the soil. Ideally, solid, copper-cored lead should be used. Carbon composite (noise suppression) type leads — as used almost exclusively on modern cars — will reduce the effectiveness of the electric fence. The copper leads also have the advantage of being more robust than the composite

types and are easier to terminate. You should be able to obtain this type of lead from an auto-electrician or accessory shop.

For an electric fence to be effective, it must be insulated (preferably by at least $1\text{M}\Omega$) from earth. This applies not only to a fence, but also to any other item which you may wish to electrify. Wet weather can be expected to significantly reduce the length of fence which can be protected, as can long grass or overhanging shrubbery.

Note that the price estimate for this

project includes only the printed circuit board, and the components mounted on it, for a battery powered unit. Although an ignition coil will be needed for both mains and battery powered units, there is a wide variation in the cost of coils available. Additionally, there is a ready supply of low-cost second hand coils. When required, the 40V mains transformer should cost approximately \$16. Added to these expenses will be a box to mount the project in, hook-up wire (including two high tension leads) and, where applicable, batteries.

Audax Compact Loudspeaker

crossover network and rear terminal panel. Connect the tweeter and install it, using four screws. Do not over-tighten these screws otherwise you will strip the holes.

Installing the Innerbond

For each enclosure you will need a strip of Innerbond 40cm wide and 1.8 metres long. This is rolled from both ends so that, in effect you end up with two rolls. This double-roll is inserted through the woofer hole, taking care not to dislodge the tweeter or crossover wires. The Innerbond should be positioned so that there is a small cavity behind the woofer.

Finally, fit the gasket for the woofer, attach the connections and screw it into place. Be particularly careful in installing the woofer, to avoid damaging it.

Use both hands when driving the speaker screws home. One hand should guide the blade to ensure that it does

... ctd from p77

not slip off the screw head and possibly damage the speaker cone.

Testing for leaks

The simplest way of testing for leaks is to connect the loudspeaker system to an amplifier and drive it at a low frequency, of around 50Hz, at a volume which is reasonably loud but which is not obviously overdriving the woofer. If you do overdrive the woofer its cloth surround will begin to buzz audibly — a sure sign that you are overdoing things.

With 50Hz signal applied, moisten your palm, cup your hand and pass it over all the likely places where leaks could occur. Go over the back panel as well as all over the corners.

When your toil is completed, place your speakers in their final positions, give the cabinets a wipe over with a moist cloth, fit the grille cloth frame and put on your favourite record. Enjoy yourself!

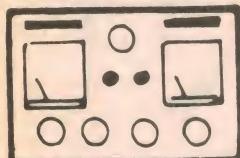
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Available from "Electronics Australia", 57 Regent St, Chippendale. PRICE \$3.50 OR by mail order from "Electronics Australia", PO Box 163, Chippendale 2008. PRICE: \$4.40.



The Serviceman

Pride goes before a fall — in income!

The complexity of colour TV sets is such that many component failures can create the weirdest symptoms imaginable. So much so that finding the fault may be quite time consuming and uneconomical. In such cases one is well advised to sink one's pride and seek help from the manufacturer's service department.

This story concerns a Sanyo model CTP7601 colour set, and is a little unusual for a couple of reasons. One was the actual nature of the fault, which had me bamboozled for quite a while, and the other was the manner in which it happened to be convenient to tackle the job.

The set belongs to a friend and, while he insists on being treated as a normal customer, this meant that I could afford to adopt a more leisurely and casual approach than otherwise. Which was probably just as well as it turned out.

My friend lives somewhat outside my usual territory, but business does take me into his area on odd occasions, and I usually take the opportunity to drop in for a yarn and a cup of brew. And it was on one such occasion that he raised the matter of the TV set.

CURIOSITY AROUSED

Naturally I wanted to know exactly what the problem was, and it was here that he bogged down. There was really no major fault as far as he was concerned. The set produced a stable picture, with normal colour, good sound and, in general behaved itself. It was the quality of the picture that worried him, although he confessed that this seemed to vary; sometimes it was quite good, at other times poor enough to be quite irritating.

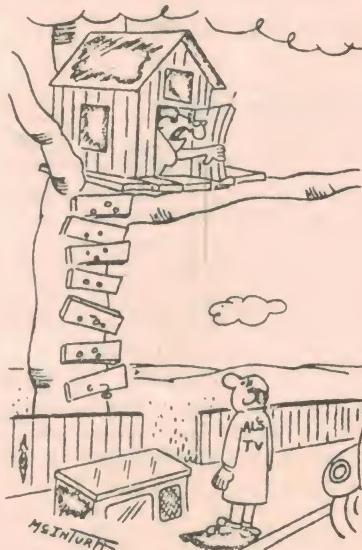
I felt this was a case where one picture was — literally — worth a thousand words, and suggested that he turn the set on and show me what he meant. When he did, my immediate impression was that there didn't seem to be much wrong with it.

So what was his problem? Was he being over sensitive about variation in program picture quality? Was it some outside influence or interference? Or was it

just plain imagination? In spite of our friendship — or perhaps because of it — I hesitated to expound most of these ideas.

So I just sat and watched the picture for a while as we downed another cuppa, and hoped for a clue. Finally I latched onto the only aspect of the picture which I felt was in any way wrong. It was, at least to my way of thinking, rather too bright, though I am fully aware that individual ideas about this vary considerably.

So I went over to the set and tried the various controls, all which behaved normally until I came to the brightness control. It was nearly full up and, as I turned it back, it had virtually no effect on the brightness for the first third of its travel; a clear indication that there was something wrong.



"What do you mean they'll be a slight additional installation charge!"

As I moved it further back the picture suddenly became quite smoky, while turning it all the way off removed the picture but did not cut off the tube, leaving the screen with a rather reddish background. In addition, there were very obvious vertical retrace lines. Well, at least I had produced some symptoms, even if I didn't have a clue as to what was causing them.

Next I tried the contrast control, and here I was less sure of my ground. The contrast range appeared to be limited but, from previous experience with this model, I had formed the opinion the range was never very great. So I simply made a mental note of the fact in case it might provide a clue later on.

I fished out the service manual and studied the circuit for a few minutes with particular attention to the brightness control circuit. This forms part of the second video amplifier stage, which includes a 2SC536 transistor (Q200). The brightness control varies the emitter voltage and, since the rest of the video chain is direct coupled right up to the picture tube cathodes, any small variation here will have a marked effect on the brightness.

Conversely, of course, if this emitter voltage is not varying as is intended, then it could create at least some of the symptoms I had observed. So it seemed a natural place to start. At the same time I noted that the contrast control was in the same part of the circuit and, in fact, is connected to the emitter via the same wire. But, whereas the brightness controls varies the voltage on the emitter, the contrast control effectively varies the impedance across the emitter resistor and, therefore, the gain of the stage.

Unfortunately, all this circuit analysis didn't help much. As far as I could tell from the voltages shown on the circuit, the range over which the emitter voltage varied seemed to make sense, so I was more or less forced to accept them for the time being.

On this basis I decided that the next logical thing to check was the voltage range on the collectors of the R, G, B

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output transistors (Q380, 381, 382). The circuit shows a value of about 190V on these collectors, without any indication of the range, and my measurements showed a range from about 85V to 230V. The 85V condition corresponded to maximum brightness and, by my reckoning, the 230V should have been enough to cut off the tube, but this was not happening.

At this stage I would have normally elected to take the set back to the shop where I could concentrate on it at my leisure. But my friend wasn't too keen on the idea. Now that the existence of a fault had been established he was quite happy to go on using the set until my next visit when, hopefully, I would have worked out the solution. (He had more confidence than I did right then.)

So we left it at that and I went on my way trying to work out a possible line of attack. After studying the circuit again, on and off over the next couple of weeks, I could think of only one possible approach. Based on experience of the last few years I have become extremely suspicious of low value electrolytics; they seem to be one of the least reliable components in modern sets.

LIKELY SUSPECTS

So, by the time I visited my friend again, I had compiled a list of likely electrolytic suspects. The first one was a $47\mu F$ (C915) associated with the brightness control circuit, but changing this had no effect. After that I changed a $10\mu F$ (C208) in the base circuit of the second video transistor, another $10\mu F$ (C201) associated with a sub-brightness control (VR200) in the emitter circuit of the 3rd video amplifier, a $4.7\mu F$ (C204) in the base circuit of the third video amplifier, and a $10\mu F$ (C207) in the collector circuit of the same stage.

The result was completely negative so, once again, I was stumped. And, while I didn't consider that I had tried all the possible culprits, one other horrible thought had occurred to me; did we have a faulty picture tube? I wasn't too keen on the theory, if only because the tube seemed to be working well in other respects.

In any case, time was running out for this visit. I put the chassis back in place and left it working as it was before. Then it was back to the workshop for another think. And the more I thought about it the more convinced I became that I was wasting valuable time looking for an elusive fault which somebody else might have already encountered and solved. Why not ring the Sanyo service department, and see if they had any clues.

So I duly made the call and was put through to a technician in the service department. I described the symptoms and then, perhaps a trifle diffidently, ask-

ed whether he had ever heard of such a fault, or could he suggest a possible cause.

"Oh yes", he replied, "That's dead easy. Replace C473, and I'll guarantee that that will fix it."

"C473? Oh yes, of course, never thought of that. Thanks very much." (Where the heck was C473, and what did it have to do with the problem?)

He went on to add that this capacitor becomes leaky and that this is the cause of the vertical retrace lines. I must confess that, grateful though I was for his assistance, I did have reservations about the likely nature of the capacitor fault, assuming that it proved to be the culprit. From my experience modern electrolytics seldom go leaky; their most common failing is that they simply dry out and lose capacitance.

Nevertheless, I hurriedly consulted the circuit and began searching for C473. It turned out to be on the Power and Deflection Unit board, nowhere near where I had been searching and, seemingly, not very closely related to the problem.

That is, until I began analysing the circuit a little more closely. Then, suddenly, a lot of things became a lot clearer. It turns out that the collectors of the R, G, B output transistors are not fed from a conventional supply rail, as I had assumed, but from a winding on the line output transformer, via a single rectifier diode (D472) and then filtered by the aforesaid C473.

Even without delving too deeply into things, it was now patently obvious that failure to filter this supply could have a lot of nasty consequences. For one thing the supply would have virtually no regulation and, for another, it would have ripple on it at the line frequency. This last thought alone was enough to make the mind boggle.

A FAULTY ELECTRO

Naturally, I was now quite anxious to get back to the set and find out whether this really was the trouble. In fact, I wrangled things a bit so that I could make the trip earlier than I would otherwise have done.

But, anxious though I was, I curbed my impatience long enough to make another check of the collector voltages over the full brightness range. They turned out to be much the same as before; from about 85V at full brightness up to 200V plus at what should have been the cut-off end.

Then, rather than replace the faulty electrolytic – it was a $10\mu F$ by the way – I simply bridged it with another $10\mu F$. And, immediately, everything was back to normal; the brightness dropped dramatically, while the brightness control could now vary the tube from full

brightness to complete cut-off. Over this range the collector voltages now varied from about 190V at full brightness to around 250V at the cut-off end.

Still wishing to confirm my suspicions about the nature of the electrolytic fault, I removed both the new one and the old one, then tried the set again. I suppose that I hardly need to say that it behaved exactly as it had when I first encountered it.

I refitted the new electrolytic, put the set back together, and left my friend to enjoy his "as new" set. But I didn't discard the old electrolytic; I brought that back to the shop and checked it on the capacitance meter. And I wasn't really surprised when it showed almost zero capacitance. On the other hand, there was no sign of any leakage.

And so another redskin bit the dust, thanks to the help of the Sanyo service technician, even if his precise interpretation of the capacitor failure was a bit off. And thereby hangs the moral of this story: don't be too proud to ask for help when the going gets tough. It may deflate one's ego a little, but not as much as too much pride can deflate the bank account.

SIMULTANEOUS FAULTS

So much for my own curly one for the month. Here are a couple of contributed stories which, in their own way, must have been just as frustrating. The first is from a now regular contributor, Mr J. L. of Tasmania, and it describes a series of faults in one set. And take particular note; one of them bears some resemblance to the fault I have just described, at least in origin, if not in effect.

Here is J. L.'s story.

How often have you found a series of simultaneous faults in a TV set? Usually the subsequent faults are hidden until the primary fault is righted, then they reveal themselves one after the other. This kind of problem is the subject of this story, and concerns a Sharp C-1831X with no picture and no sound.

A quick check showed that the main HT rail was OK, and that there were no obvious shorts. But the line output stage was a different matter; it was not working, and for the simple reason that the line oscillator was dead. But why? All the transistors were OK, as were the secondary supply rails.

However, there was something wrong around the oscillator (Q602). Its emitter did not connect to the 25V rail as the circuit said it should, and the culprit turned out to be the oscillator coil (T601), which was open circuit. But it was the manner of the open circuit that surprised me. One lead to the coil was so corroded that it came away on the soldering iron and the whole coil was covered with a

THE SERVICEMAN — continued

sticky brown goo which I suspect might have been dried beer.

A new coil was eventually fitted and the set came to life with good sound and a bright white screen. But no video. In cases like this I try to establish whether the video is really missing or is being swamped by an overbright screen. When a set dies the owner often turns every control and adjustment he can find. I have chased missing video for hours, only to find a pre-set brightness control turned flat out.

In this case there was no video at the tube cathodes and none at the video drive transistor (Q207). Backtracking further along the video chain I established that there was no video at the luminance delay line, nor any at the output of the first video amplifier IC (1203). However, there was healthy video at the input to the IC, so it looked as though this was the culprit. This was confirmed when a voltage check showed that only one of the seven pins had anything like the correct voltage.

The type number of this chip is on the circuit as RH-IX 0035CEZZ and I had none in stock. I ordered a new one from the agents and this was marked TA7069. I fitted it in place of the old one, which also turned out to be marked TA7069, so why that RH etc mouthful on the circuit?

Anyway, it was quite a letdown when the new chip produced no more video than the old one, while the voltages were more wildly out than before. It was enough to make one hang up the soldering iron permanently.

A FAULTY CHIP?

Believing that I had received a faulty chip from the agents I removed it with the intention of returning it. And, so that I wouldn't forget the orientation, I replaced the original dud. And guess what? The voltages dropped back to normal and there was a trace of video on the screen.

The scope showed that the video was now normal right up to the output stages, but was very weak at the collectors of these three stages. So now we had another fault. It turned out that these collector voltages were very low, only about 30V instead of the 130V specified. And, since they were all the same, the fault had to be in a common supply to all three collectors.

This supply comes from a winding on the line output transformer via a diode, a resistor, and a capacitor. There was more than 600V at the cathode of the diode (D916), so where was it being lost between there and the collectors?

It could only be either a high resistance or a faulty filter capacitor. With a choice of two likely faults, Murphy's law states

that you will always pick the wrong one. Well, Murphy won't like me because I chose the resistor and, instead of 47Ω , it was more like $470k\Omega$. A replacement brought up a first class picture and the job was done.

This job was unusual in that the start and finish were quite straightforward, while the middle was totally mysterious. Why was the original IC not processing video? A dry joint at one of the pins? But, if so, wouldn't that have been taken care of when I fitted the new chip? Surely it would be stretching coincidence too far to suggest that one would make a second dry joint in place of the first one.

And how lucky I was that I chose to replace the "dud" just so that I wouldn't forget which way round it went.

SHORTWAVE RECEIVER

Thank you J. L. for another interesting story. I agree that a sequence of faults like this can be most frustrating, particularly when they involve an unsolved mystery. On the other hand, there doesn't seem to be much one can do about it, except hope that it won't bounce.

The other contribution comes from W. B. of Victoria, and was inspired by one of my own stories about salvaging a transistor radio. Here is his story.

I read with interest your item about the National R-238-W dual-band radio in the April 1981 issue. I repair the occasional radio in my spare time and I have had two of its brothers, the R-238-R tri-band version, brought to me by owners who felt it wasn't worth taking them to the local serviceman.

The first owner complained that "it sounds distorted". I measured some voltages in the output stage, but they didn't make much sense and seemed to be rather high. Then I measured the current drain of the set, and this turned out to be a whopping 300mA, instead of about 20mA.

This suggested a faulty output transistor, although a test with the ohmmeter failed to find the faulty one. While taking voltages, with the board out of the case on the end of clip leads, I noticed a joint which had almost no solder on it, and I resoldered it, just in case. It was at the earthy end of the base resistor for the lower output transistor. In fact, it made no difference.

Obtaining replacement 2SB324s was not easy, but I managed it and these completely cured that problem. But that was not the only fault. I also encountered trouble with the spring and pad connections, the owner having complained that the dial light would not work and that the set occasionally went dead.

What he didn't tell me was that he had had the set at the beach and, inevitably, collected some sand in it. You can probably guess the effect that salty beach sand had had on those contacts. Fortunately, a good clean up and retensioning cured the trouble, and the owner was delighted with the result.

The next owner of the same model set also complained of distortion, but when I listened to it I felt sure it wasn't the same trouble because the distortion sounded quite different. I checked the total current drain and this time it was closer to the normal 20mA.

Then I remembered the almost solderless joint in the previous set and an inspection showed very little solder. Resoldering it restored normal sound. Incidentally, this fault could be disturbed by applying pressure on the case, but could not be traced in this way as pressure anywhere had the same effect.

And on the subject of faulty soldered joints, one sometimes encounters joints which have obviously never seen solder. One such was a Sanyo radio-cassette player, the complaint being that the tape transport had failed. I checked the voltage up to the motor, and found it to be a trifle high suggesting that it was not drawing current.

Getting into the motor was a major job, involving an outer casing and then a shrink plastic wrap. But when I did I found that the incoming cable was soldered to two pads and from one of these a small coil of about 10 turns completed the circuit to one of the brushes. (Apparently an RF filter.)

NO SOLDER!

And the cause of all the bother was at the brush end of the coil; there was not a trace of solder, or even flux. How do these things get through quality control?

I resoldered the joint, put the motor back together, and the owner was delighted. He had saved the cost of a new motor which had been quoted to him by another serviceman.

Thank you W. B., and I can certainly appreciate your problems with those portable sets, particularly those involving the contacts and the effect of the beach sand. As for the problem of unsoldered joints, this is more common than you might imagine. It seems that they get through "quality control" on the simple basis that if it works it's OK. Visual checks are often honoured more in the breach than the observance.

If you have a factual and interesting story to tell about electronics servicing, write it in your own words and send it to "The Serviceman", c/- "Electronics Australia", Box 163, Chippendale 2008. If the Serviceman uses it in his column, we will pay an appropriate fee.

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Add-on for improved sound

Dynamic noise reduction filter

This article describes a dynamic noise filter which is very similar in operation to the recently released National Semiconductor dynamic noise reduction IC (DNR). It can be used to reduce the noise content of any audio program source such as a cassette deck, VCR or FM tuner.

by LAURIE TUNNICLIFFE*

There are a number of add on noise reducers available. However, the majority of these rely on encoding and decoding. This means that if the source has not been encoded, then decoding will not give the improvement expected. In order for these units to function correctly an accurate and stable means of control must be exercised over the signal on record and playback.

Dynamic noise filtering relies on two main techniques. That is, it is used on playback only. It can be used to improve the effective signal to noise ratio of tapes, tuner or disc. This means it is a versatile piece of equipment for the serious listener. In addition, it is inexpensive to build and easy to use.

Dynamic noise filter relies on two assumptions for its operation. First, if a program signal contains only low fre-

quencies, a wide bandwidth is unnecessary. Second, if two high frequencies are present, the loudest of the two will tend to mask the other. In other words, a high frequency signal will tend to mask high frequency noise.

Given these two assumptions, the circuit was designed to sense the high frequency content of the music being processed, and to increase the bandwidth as the high frequencies increase. By examining Fig. 1 it can be understood how this is accomplished. Each channel is buffered to give a high input impedance, and a low output impedance to drive the voltage-controlled filter. The VCFs are controlled by varying the resistance of a light dependent resistor via a LED.

The two channels are mixed prior to the filter, and the signal is amplified by three. The resultant of the two channels is attenuated by the sensitivity control and then passed through a high pass

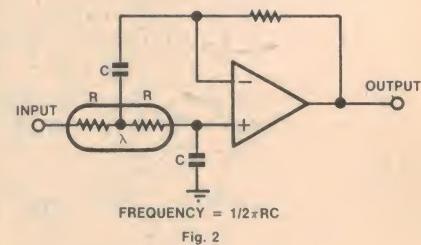


Fig. 2

filter. This removes the unwanted low frequency content. The filter has a cut-off point at 4kHz.

After removing the low frequencies, the signal is converted to DC by a precision rectifier and filter capacitor. The rectifier also provides the remaining gain of 10. The DC signal is then summed with a bias voltage, which allows the VCF's cut-off frequency to be established in the absence of any signal. The resultant control voltage is converted to current in order to drive the LEDs, and in turn, they control the filter. It can now be seen that only high frequencies will control the filter, and therefore a wide bandwidth will only be provided when it is needed.

We will return to the VCF for a moment as it is the heart of the dynamic noise filter. There are a number of ways of constructing a voltage-controlled low pass filter, but generally you must control one or more resistors or capacitors in order to vary the cut-off frequency.

The filter settled upon is a second-order Butterworth design. This gives an attenuation of minus 12dB per octave after the cut-off frequency, and a flat response in the pass band up to the cut-off point. Fig. 2 shows the VCF. During the investigation into the design, I considered using FETs in the ohmic region, this being a popular way of achieving a voltage-controlled resistor. However, to obtain four (for stereo) FETs that are matched would prove a difficult task for the amateur constructor. In addition to this FETs are inherently non-linear in this mode of operation and can cause excessive distortion unless signal levels are kept low.

The Butterworth filter lends itself well

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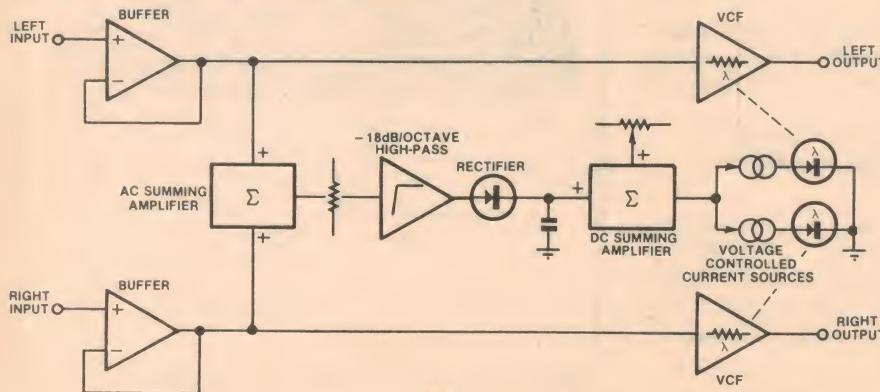


Fig. 1

Fig. 1: Block diagram shows how the dynamic noise filter works. The two input channels are separately buffered and passed through voltage controlled filters.

to a centre-tapped LDR. The matching and tracking of the two halves are excellent since they are manufactured together. Linearity is good, so distortion can be kept down to levels which are quite respectable (less than 0.1%).

The resistance versus incident light is essentially linear, which means a doubling of control voltage will double the filter's cut-off frequency. A decrease in resistance occurs very quickly and this helps in giving the unit a fast attack time. The return to high resistance is a little slower (approximately 100 milliseconds), but this is more than adequate for processing music.

The circuit diagram

Refer now to Fig. 3 to consider the complete circuit. IC1a and 1b are non-inverting buffers giving an input resistance of $47k\Omega$ set by the input resistor. The associated coupling capacitor sets the low frequency minus 3dB point at 20Hz. The outputs of the buffers are directly coupled to each VCF and are also summed by IC1c which has a gain of 3.3.

The output of the VCF is coupled to the main output via a 100Ω resistor, and $100\mu F$ bipolar capacitor. This removes any DC offset and provides isolation from unhealthy loads. The $10k\Omega$ pot following the summing amplifier provides control over varying signal levels, that will occur from one piece of equipment to another. It allows a variable amount of signal to be passed on to the high pass filter.

This provides a minus 18dB per octave attenuation after the cut-off point by using a second-order Butterworth filter (12dB/octave) and by selecting the coupling capacitor of the next stage, to give a 3dB point to coincide with the filter.

Following the filter is the half wave rectifier (IC2a) and filter capacitor. The filter capacitor is charged to the peak value of the waveform and this provides a fast attack time. The rectifier also provides the remaining gain of 10. A precision rectifier has the virtue of providing rectification down to very small signal levels by incorporating the diodes within the feedback loop of an op-amp.

The resultant DC is summed with a variable DC voltage in IC2b. The DC voltage is varied by VR2 which forms the bottom leg of a voltage divider and is used to set the VCF cut-off frequency in the absence of any signal.

The sum of the two DC voltages is the control voltage that is used to adjust the

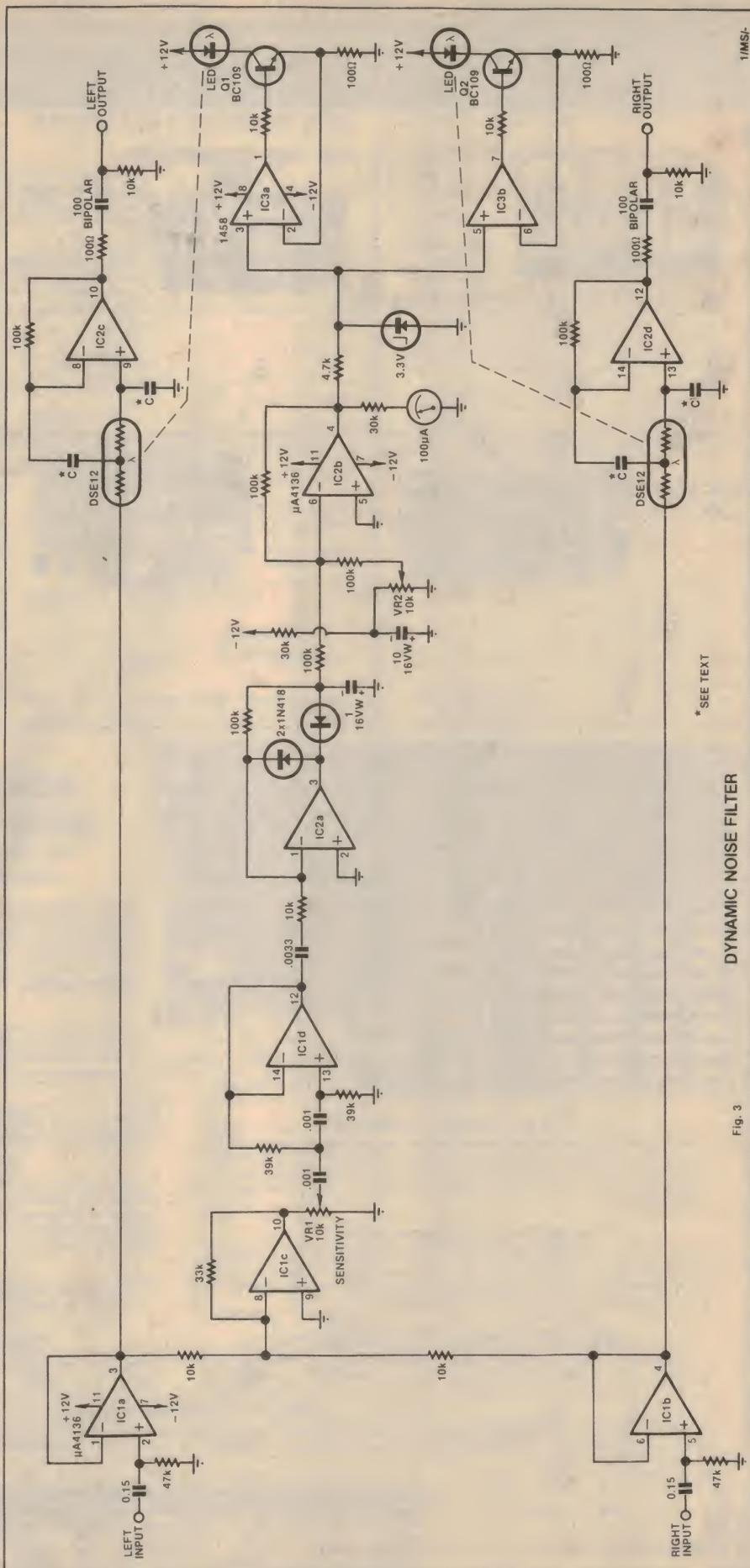


Fig. 3: At right, the complete circuit diagram of the dynamic noise filter. Each voltage controlled filter uses a centre-tapped light dependant resistor.

DYNAMIC NOISE FILTER

Fig. 3

Dynamic noise filter

filter's cut-off point. The meter M1 displays this DC voltage and is calibrated in kilohertz to give a visual display of the filter's instantaneous cut-off frequency.

IC3a, 3b, Q1, Q2, and the associated components, convert the control voltage to current in order to drive the LEDs. This ensures that voltage versus light output will be as linear as possible. The 3.3 volt zener diodes catch the control voltage and are used to limit the LED current to a non-destructive level.

The LEDs are coupled to the LDRs and the filter's cut-off frequency is thus proportional to the control voltage. Fig. 4 shows the filter's cut-off frequency versus voltage for my prototype. It can be seen that it is essentially linear.



Fig. 4: Filter cut-off frequency vs voltage.

Construction

Any of the normal construction techniques may be used and the final choice will depend on the constructor's past experience. I prefer to use tag strip and wire wrap sockets for "one off" work, as any changes or developments can easily be incorporated. The LED and LDR are held together with "Heatshrink" tube as shown in Fig. 5. I used a hair dryer to shrink the tubing. This holds the assembly together neatly and will help exclude any unwanted light.

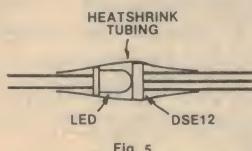


Fig. 5: Construction of LED/LDR pair.

My prototype was built with wooden ends and aluminium plate as this complemented some existing equipment I already had. There are, however, an abundance of instrument cases available if you wish a good finish without having to spend too much time on the housing.

Calibration

Although I have not tested many LDRs, I believe that there is enough variation between them to necessitate calibration of the unit. I was able to align the filters easily since I possess a CRO. However, many readers will not. It is possible to calibrate the unit by varying one of a few components but the explanation of all these variables would take some time. In order to make calibration simple, the following steps should be followed.

1. Connect the LED to a voltage source via a resistor. The resistor is calculated to allow 20mA to pass through the LED by the formula

$$R = \frac{V - 1.7}{.02}$$

2. With LED illuminated, measure one half of the LDR with an ohmeter, and note the value.

3. Calculate the value of the capacitors to be used in the VCF by the formula

$$C = \frac{1}{2\pi R \cdot 20,000}$$

where R is the resistance of the LDR.

The process is then repeated for the second channel. With the capacitor value chosen, the filter can be controlled to 20kHz by a control voltage of 2V RMS. The meter is calibrated to read 30kHz FSD by varying the series 30kΩ resistor.

Operation

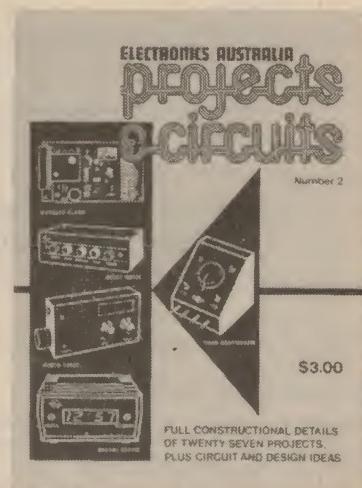
If the DNF is to be used on tape or tuner, it is connected in series with the output of these. If it is to be used for disc it is connected in the tape loop of your amplifier.

The initial adjustment of the unit is as follows: First set the DC bias control to maximum and the sensitivity to minimum. The music should sound natural with ample high frequencies. Slowly reduce the DC bias until you can hear a considerable reduction in the background hiss.

Now the sensitivity control should be slowly increased and the music should now regain its high frequency content. The operating procedure is given as a guide. Correct adjustment will depend on the type of music being processed. I encourage you to experiment with different settings in order to obtain maximum noise reduction with minimum noticeable side effects.

After using the DNF for some months, I can say that I now have records in my collection that I had previously considered throwing away. I hope you will receive the same benefits and will continue to listen to old favourites that may have otherwise collected dust.

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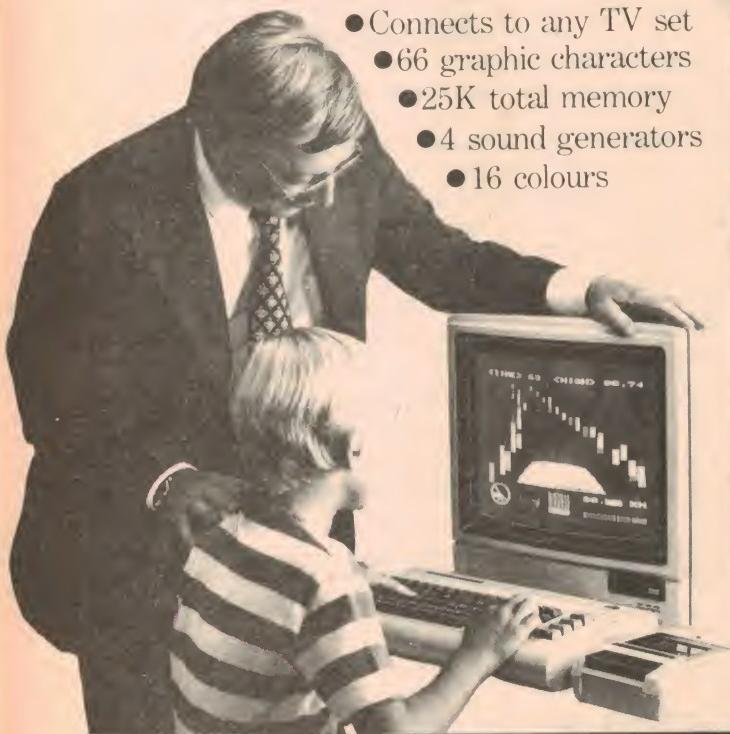
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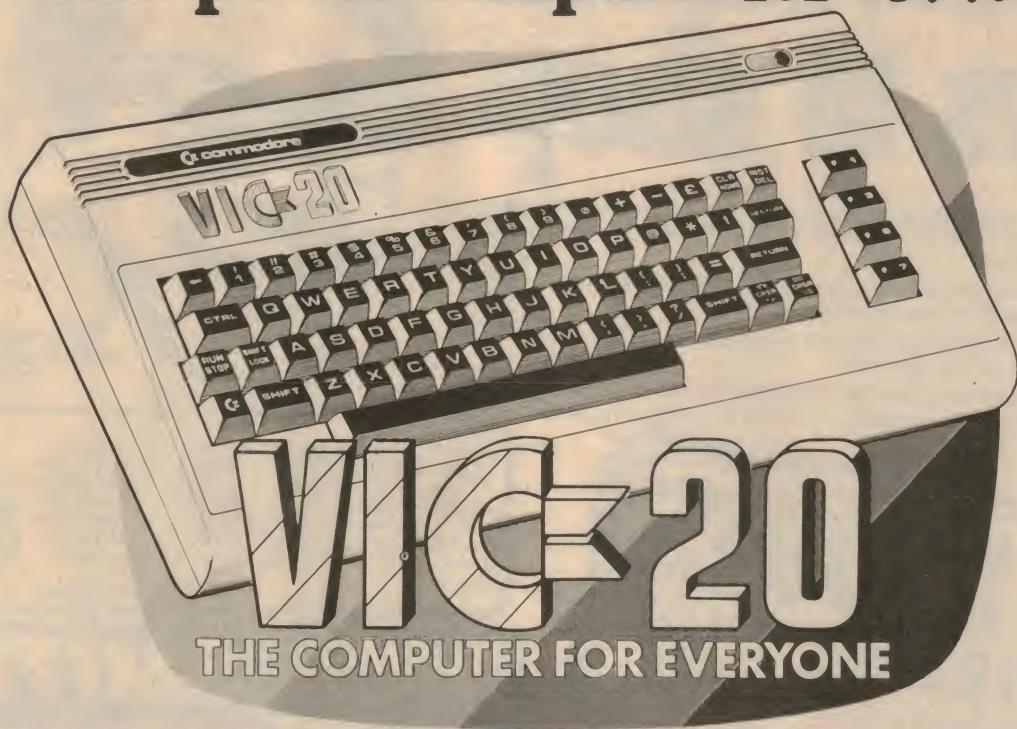
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As far as constructional projects go, this is no doubt one of our simplest. But although it only involves the connection of two wires, you have a digital readout of the distance travelled on your bicycle. Read on to find out how.

While inflation has dramatically increased the price of most products over recent years, some, such as computers, digital watches and calculators have actually decreased in cost in real terms. Indeed, calculators can now be bought so cheaply that it makes sense to incorporate them in gadgets which may only utilize a small portion of their capabilities. Such was the case with this velocipede odometer.

Several cycling enthusiast friends had been hounding me to come up with a simple and cheap odometer to replace their existing mechanically driven devices, which they claimed had unacceptable friction losses. Whether they were puritans wanting every ounce of effort to result in forward linear motion or merely gadget fanatics wanting to be the first on the cycleways with frictionless electronic odometers, I came up with the following solution.

All you need is a simple calculator and a magnetic reed switch. Let us consider the calculator first.

Almost any calculator will do, the only requirement being that the addition operation must have a "constant mode". This means that if you key in for example:

$$6 + 1 =$$

the sum 7 appears in the display while the 1 is retained in the constant memory so that if you then key in:

$$3 =$$

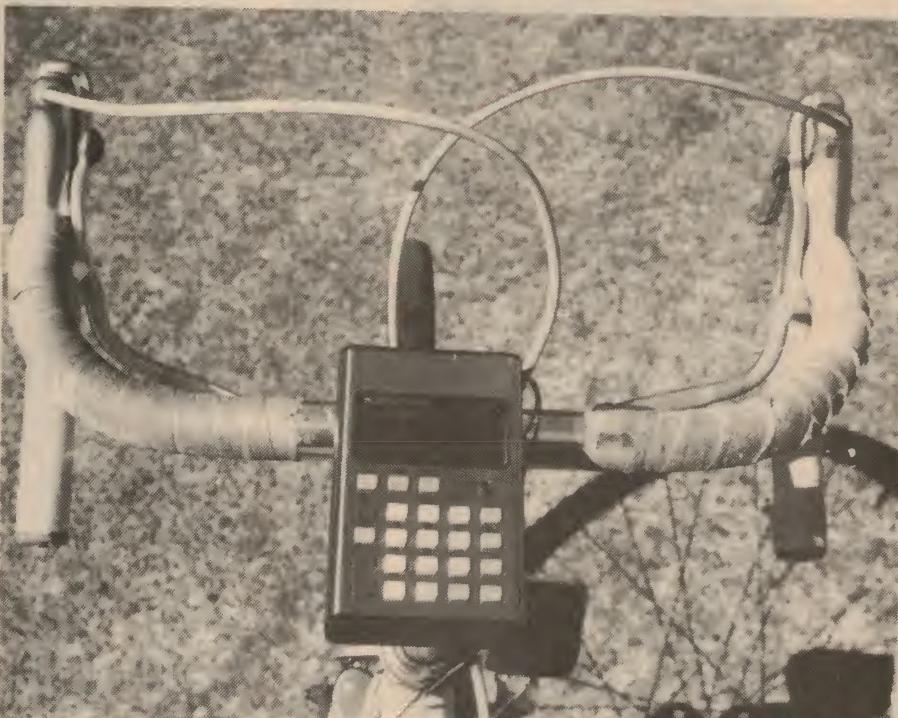
a 4 (the sum of 3 and 1) appears in the display, and if you key in:

$$1026 =$$

1027 appears.

While this may sound complex, nearly all calculators function in this manner. Indeed most calculators also have an analogous constant multiplication mode, but that doesn't concern us here.

To test whether your calculator can perform constant additions, simply try



A reed switch and two simple connections turn a calculator into a bicycle odometer.

the example above, ie key in:

$$6 + 1 =$$

$$3 =$$

$$1026 =$$

and if the display shows successively 6, 1, 7, 3, 4, 1026, and 1027, you're all set.

As a consequence of the constant mode, if you key in $0 + 1 = \dots$, the display will show:

$$0, 1, 1, 2, 3, 4, 5, \text{etc.}$$

In other words, the display increases each time you depress the equals button by the value of the second number in the sum.

Now if instead of keying in $0 + 1 = \dots$, you key in $0 + (\text{wheel circumference}) = \dots$, then with every depression

of the equals button, the display will increment by the distance your bicycle travels during one full revolution of the wheel. Therefore, all you need now is a switch which will activate the equals function every time the wheel completes a revolution.

This can be done in several ways, eg, with an opto interruptor, a Hall-effect device or a magnet and pick-up coil. However, none of these methods is as simple and elegant as using a magnetic reed switch.

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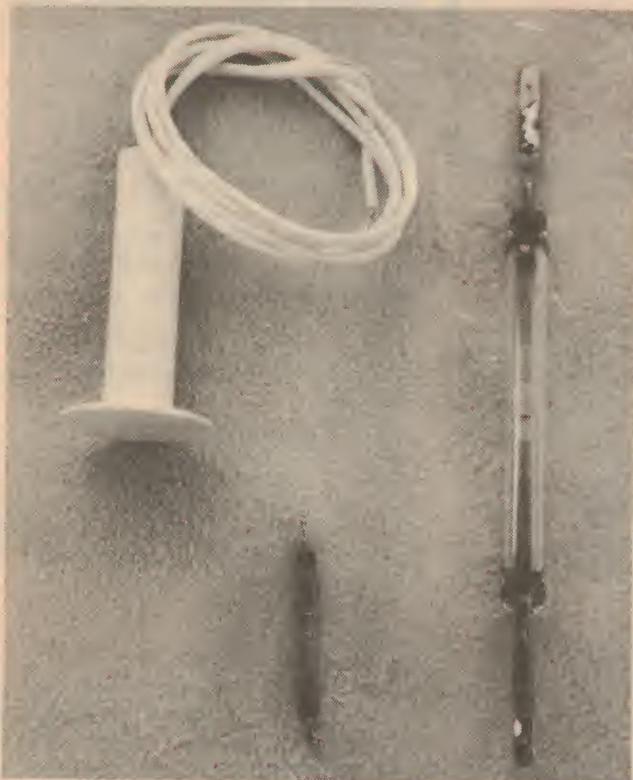
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Reed switches come in many different shapes and sizes.



The selected reed switch can be taped to the bicycle fork.

presence of a magnetic field of sufficient strength, they bend and snap together allowing a current to pass. When the magnetic field is removed, they open up again.

By connecting the reed switch in parallel across the terminals of the equals button of a calculator, and mounting a magnet on a wheel so that it comes in close proximity to the reed switch during each revolution, you have a complete odometer.

Magnetic reed switches are available from electronic hobbyist supply shops and burglar alarm outlets. They may be salvaged from other equipment, such as some large desk-top calculators that use one for each key. Some reed switches come complete with magnets, but if not, you may purchase an ordinary magnet or salvage one from an old meter movement or electric motor.

Construction

Open the calculator and locate the two conductors associated with the = button. This is best done by visual inspection, as the use of a multimeter (especially in the ohms mode) may blow the calculator. Solder two wires to these conductors at any suitable point. The polarity is unimportant. You may have to drill a hole or cut a notch in the calculator housing to feed the wires through. If there is room, you could install a jack plug and socket and thereby

be able to disconnect your calculator when you want to do some "number crunching".

Connect the wires from the calculator to the contacts of the reed switch. The reed switch itself should be mounted on one of the forks of the bicycle. The shape of your switch will determine the mounting method. If the magnet can be made to pass close enough, it would be adequate to simply tape the reed switch to the fork. In any case, it is vitally important to ensure that the switch is secure, as otherwise the switch and wire attached to it could get tangled in the wheel. To maintain switching reliability at high speed, mount the reed switch as close to the wheel's axle as practicable.

Mount the magnet on the appropriate wheel, bearing in mind that it will have to pass close to the reed switch. Once again the exact mounting method will depend on the size and shape of your magnet. A non-ferrous bracket clamped to two of the spokes and holding the magnet results in a sturdy arrangement. Note that some reed switches operate more effectively with particular orientations relative to the magnet. Test this, either by listening to the clicks of the closing switch contacts or by watching the display of the calculator, and adopt this orientation.

The calculator may be mounted somewhere on the bicycle or slipped into a pocket.

Calibration

All that remains to be done is for the odometer to be calibrated. Turn the bicycle wheel until the valve is at the lowest point of its circular path, and mark this spot on a driveway or footpath. Push the bicycle forward in a straight line and mark the spot where the valve is next at its lowest point. Now measure the distance between the two marks. This is the wheel circumference and is the number you must feed into the calculator.

If, for example, the circumference is 1.95m, you would key in 0 + 1.95, and every time the wheel completes a turn the display increments by this amount, showing the total number of metres travelled. Alternatively, you may key in 0.00195 (1.95m/1,000m per km) to clock up kilometers.

Finally, if you note the duration of your ride, you can use the calculator to obtain your average speed.

Editor's note

There are two caveats to this project. Liquid Crystal Displays used in most modern calculators can be faded or permanently damaged by heat and sunlight, so take appropriate precautions. Those calculators with LED displays are heavy on battery consumption, which may make them less attractive for this application.



Letters to the editor

Dam that Gordon River editorial

I am composing this letter in the comfort of an all-electric house while listening to news about the latest power restrictions in NSW. Outside the temperature is about 0°C. I would now like to give Leo Simpson some facts that he seems to have omitted from his June editorial.

It appears to Tasmanians that the most vocal people against the flooding of Franklin River are those on the mainland. Maybe they are envious of us because we have no power restrictions as recently occurred in NSW.

We have had our election and the majority of Tasmanians have again supported damming the Franklin. The HEC is not the largest employer in the state, but it still employs 3000 personnel and is directly responsible to the Minister for Energy.

The HEC is a large employer during the construction stages and when one site is completed the crew moves onto the next construction site. Personnel are left behind for maintenance, operation and tourism purposes.

Each area of the hydro scheme has its own control centre under the authorisation of System Control which is based in Hobart. People are always complaining that we have too much power in this state, but have always neglected to say that with regular maintenance on the machines (up to six months for a rewind) plus the unexpected breakdowns that can occur, we have enough generated power to cover ourselves without any restrictions.

I am very disappointed in your magazine for printing such political bias in the first place.

Stephen Felmingham,
Tarraleah, Tasmania.

Leo Simpson replies:

If, as you say, the most vocal people against the flooding the Franklin River are from the "mainland" perhaps it is because they have a better perspective. After all, are not "mainlanders" (a Tasmanian term) entitled to have a view about a particularly beautiful part of Australia. The Franklin River is part of Australia and all Australians will pay, at least in part, for the dam that will forever change the landscape.

Your comment about the large construction crew employed by the HEC is revealing. Is the Franklin River being dammed merely to provide another construction project to keep the crew going for another few years?

Since both major political parties supported the dam project, we reject your accusation of political bias.

If it is any consolation, not all EA staff members agree with me.

What's it got to do with electronics?

After over 30 years of readership I am incensed enough to write.

It concerns the Simpson editorial in the June issue. What the hell has the Gordon River Scheme to do with an electronics magazine? I buy the "Bulletin" and daily rag for (mis)information on politics and do NOT expect it to emanate from your pages. The queries that Mr Simpson succeeds in inspiring from me are:

- (1) How much credibility does he expect to inspire in his readers if this represents considered and balanced journalism?
- (2) How much research goes into the printed word in the magazine?

I ask these questions because of the unbalanced and incorrect statements made. Samples:

- "The major and perhaps the only issue in the campaign was the desirability of one or other of the Hydro-Electric Commission's dam schemes for the Gordon River system." If Mr Simpson had done his research properly he would have discovered that the matter had been decided by compulsory referendum (perhaps not democratic enough for the "greenies" because it did not abide by their "rules") several months before the election. It was not an election issue. Both major parties agreed the dam was policy.

- "One must visit there to see how all powerful and ubiquitous the HEC is in Tasmania." As one who lives here may I assure your good readers that the only time we come into contact with the HEC is quarterly at account time. Their power and function is to provide power. For their success in doing so I thank them, not condemn them.

Enough of quotes. I deeply resent the opinions of instant "experts" like Mr Simpson who pontificate in ignorance from great heights on topics which are not their personal or professional concern. The proposed scheme is no dearer than others we have built. The propaganda of the wilderness society has been deceitful and dishonest, and more fool Mr Simpson for falling for it.

The quoting of incorrect construction costs and TV airing of footage of the river that will not be affected by the dams are typical of the emotional garbage we have had to put up with here in "Tassie" in the last couple of years. It really was too much to see more misleading verbiage oozing out of your magazine.

Mr Williams, I respectfully suggest you have a more relevant editorial policy – an electronic one please. Mr Simpson has every right to his opinion, but you have the right over whether or not that opinion is relevant or appropriate to your publication.

John Coulson,
Dilston, Tasmania.

Leo Simpson replies:

It is valid for "Electronics Australia" to comment on a large technological project which should be of great interest to engineers. Or are engineers considered to be totally blind to the effects of technology on the environment?

Having done my research, I am aware that the referendum you refer to gave a choice between two dams. A large number of voters, some 17% or so, voted informally and wrote "no dams". This is a long way from a majority being against the scheme, I grant you. However, the dam was an issue, otherwise the large number of independent candidates would not have run.

Power scheme to improve conditions

I have been a reader of your magazine for many years, right back to the "Wireless Weekly" days. Have built up a good many of the different designs of radio sets, test equipment and amplifiers and have been very pleased with the results. I think your magazine has been doing an excellent job in catering for those people interested in electronics over the years.

However, I was very disappointed to read the leading article in the June publication. Actually I was and am still very annoyed with the article, which is mainly full of incorrect statements and assumptions about the power position in Tasmania.

It would be better for Leo Simpson to stick to writing about something which he does understand. In Tasmania we

Tertiary courses for electronics engineers

I write to correct the most unfortunate misinformation contained in June's "Information Centre" is answer to a young reader's request for ideas and opinions on becoming an electronics engineer.

Firstly, while undoubtedly it is a "hard slog", the courses are not generally uninteresting if approached with a general desire to learn. They are not always six-year part-time courses either. Four-year full-time degrees are available at most institutes and universities. Generally, it's worth shopping around to find the course which suits your requirements.

Secondly, while it is fashionable to knock public servants, your comments about having a better chance of doing substantial work in private industry and of having to work harder in the private sector are simply untrue as generalisations. Engineers working in the public and private sectors are not very different in their workloads. Some work hard, others do not.

As for the quality of experience, it all depends on just what you want to do.

You do not write for electronics magazines in the public service, nor do you design power grid control systems in private industry.

Thirdly, the reasonableness of an engineer's salary depends on just whose you compare it to. I'd do medicine next time if only money interested me.

You have done your reader a disservice. By the way, I do not work in the public service.

Greg Smith,
Annandale, NSW.

Comment: The opinion about the courses being not generally interesting is a fairly common attitude expressed by students. It is true that four-year sandwich courses are available.

We are aware that some engineers working in the public service do have a heavy workload. However, we have had three engineers on our staff in the last 10 years or so who came to work for our magazine for less money than they received in the public service. The reason: they were bored and under-worked in the public service.

have had to put up with deliberately misleading and often false propaganda about the southwest of Tasmania and the Franklin river for over two years.

It is amazing to note what propaganda can do. However, you cannot fool all the people all the time. When it came to an election the vast majority of Tasmanians voted for a party which will endeavour to improve conditions in Tasmania and go ahead with the next power scheme.

The Hydro-Electric Commission has an excellent record in estimating and providing power for all requirements in Tasmania over many years. In fact, it has a world wide reputation in spite of the attempts of the "wilderness minority" to denigrate the reputation of the Hydro-Electric Commission and its engineers.

V. E. Roberts,
Howrah, Tasmania.

Leo Simpson replies:

There is no question that there is a vast reserve of talent in the HEC, as far as building dams is concerned. Unfortunately though, the HEC is a large bureaucracy which has a natural tendency to grow and expand. What better way to do this than to continue building even more dams. And what better way to justify this than to point to projections of growing power demand.

However, the demand for power is not inelastic (in other words, unaffected by price) as recent tariff increases in NSW have shown. A relatively small tariff increase and/or a cessation or reduction of metal refining at Bell Bay or Risdon (EZ Industries are continuing to reduce their staff) could make nonsense of the HEC projections.

Looking for a hefty 13.8V power supply?

If you are looking for a power supply for a transceiver, have a look at the VK Powermate which we published in May 1978. This rugged, fully regulated supply gave a genuine 5 amps with low voltage regulator losses, using the Dick Smith M-2000 transformer, one 2N3055, one TIP32 and a 723 regulator. In addition details were given in the article to boost the output to 7.5 amps using a bigger transformer.

Naturally a PC board is available, code 78ps5. Limited stocks of the May '78 issue are available at \$3 including postage. Write to PO Box 163, Chippendale, NSW, 2008. Other back issues are also available.



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Books & Literature

Integrated Circuit Engineering



BASIC INTEGRATED CIRCUIT ENGINEERING by D. J. Hamilton and W. G. Howard. Published 1975 by McGraw-Hill, Inc, New York. Hard covers, 235 x 160mm, 587 pages, illustrated with circuits and diagrams. Price \$25.90 plus sales tax. ISBN 0 07 025763 9

Part of a Motorola series in solid-state electronics, this text gives an in-depth treatment of four major aspects of integrated circuit design: fabrication techniques, device design, linear circuits, and digital circuits. It is aimed at the student of electronic engineering and could well be a preferred text for undergraduate courses even though it was first written some seven years ago.

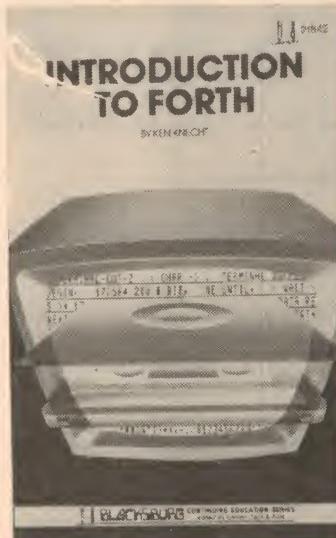
Chapter headings are as follows: (1) Basic Processing Technology and Layout Fundamentals, (2) Diffusion-related Processes, (3) Other Processing Methods, (4) Passive Components and their Parasitic Effects (5) Integrated Junction Gate Field-Effect Transistors, (6) MOS Field-Effect Transistors (7) Bipolar Transistors and Diodes (8) Thermal Effects in Integrated Circuits (9) Basic Linear Integrated Circuits, (10) Integrated Operational Amplifiers, (11) Applications employing Linear Integrated Circuits (12) Basic Saturating Logic Circuits, (13) Non-saturating Logic Circuits, (14) Basic MOS Logic Circuits and (15) Applications of Digital Integrated Circuits.

Naturally, there are recent developments in IC technology which are not covered. Fet-input op amps and

bucket-brigade devices are two which come to mind. However, the text is very well presented, easy to read and can be recommended for any engineer's bookshelf.

Our copy came from Soanar Electronics who are selling the text at \$25.90 plus tax. (LDS).

Introducing Forth



INTRODUCTION TO FORTH: by Ken Knecht. Soft covers, 142 pages, 134mm x 238mm. Published by Howard W. Sams & Co Inc 1982. ISBN 0-672-21842-9. Price \$14.95.

Although called an "Introduction to FORTH", this book is really about MMSFORTH, the version of Forth available for the TRS-80 Model I and Model III computers, which differs considerably from the standard Fig-Forth implementation. In most cases, the differences enhance Forth for the TRS-80 computers, including features to take advantage of TRS-80 graphics, printer interfaces etc. An unusual addition is a set of string handling words, not found in standard Forth (most programmers prefer to write their own, tailored to their own requirements).

After discussing loading the Forth disk on a TRS-80 system, explaining

arithmetic operations and disk I/O, the book proceeds to discuss programming in Forth, as compared to Basic. In some ways, this is not the best way to go, as Forth and Basic are conceptually very different languages, and procedures which are useful in Basic might actually prevent the programmer from seeing a better way of doing the same thing in Forth.

Given that this book is aimed at users of the TRS-80 who are experienced in Basic, though, the approach is justifiable. If you are interested in running a version of Forth on the TRS-80, "Introduction to Forth" would be useful. Before buying the book, though, make sure you can get a copy of the Miller Microcomputer Services Forth (the MMSForth discussed here).

Our review copy of "Introduction to Forth" was supplied by McGill's Authorised Newsagency, 187 Elizabeth St, Melbourne. (PV).

6809 Manual

MC6809-MC6809E MICROPROCESSOR PROGRAMMING MANUAL: Soft covers, 140 pages, 216mm x 280mm. Published by Motorola Inc 1981, Price \$19.95.

This Motorola publication is a complete description of the operation, mnemonics and addressing modes of the 6809 and 6809E microprocessors. It includes a complete description of both versions of the 6809, pin assignments and bus signals, a fully annotated instruction set, and a commented listing of a powerful 6809 monitor program called ASSISTO9. Numerous charts and tables of the instruction set, op codes and hex conversion charts complete the book. The programming manual would find a place in the library of anyone interested in the 6809 microprocessor.

Our review copy was supplied by Paris Radio Electronics, 7a Burton St, Darlinghurst, Sydney 2001. (PV).

History of Maralinga

MARALINGA: BRITISH A-BOMB AUSTRALIAN LEGACY, by Adrian Tame and F. P. J. Robotham. Fontana Press, 1982. Soft covers 130 x 195mm, 272 pages, illustrated with photographs. ISBN 0 00 636391 1. Price \$5.95.

This book is an account of the British experiments and atomic bomb tests held in Australia between 1953 and 1963. It concentrates on the events at the major test site, Maralinga, about 400 kilometres northwest of Adelaide, South Australia. One of the authors (Robotham) is a physicist with long experience in radiation studies, while the other is a journalist who has spent considerable time researching the effects of

Agent Orange and nuclear weapon tests.

The authors' stated purposes are to bring together as much material as possible about what happened at Maralinga, both at the time of the tests and the later clean-up.

The first part of the book is a description of the early history of nuclear research and the atomic bomb project and a discussion of the physics of bombs and nuclear fall-out. Then follows an account of the campaign by the Australian Nuclear Veterans Association to win compensation for some of the 3-4,000 Australian servicemen and civilians and hundreds of Aborigines who may have been exposed to dangerously high levels of radiation both during and after the bomb tests.

Contrary to government pronouncements at both the time of the tests and as recently as 1981, the authors produce eye-witness accounts of the uncontrollable drift of fall-out clouds across the centre of Australia and of totally inadequate safety precautions, even in the light of the scientific beliefs of the 1950s. One airman speaks of flying monitoring planes through the mushroom cloud of the explosion, protected by an oxygen mask "which he only removed when eating". Others were ordered into the atomic test sites without protective clothing and without being advised of the dangers they faced.

The book concludes with a roll call, of 113 Australians who have died, mostly of cancer, after working at Maralinga. These are people of which the ANVA has documented working conditions and exposure levels. They may only represent a small proportion of those adversely affected.

Our review copy was purchased at the University Co-op Bookshop, Sydney. (PV).

More on Forth

STARTING FORTH: by Leo Brodie. Soft covers, 347 pages, illustrated with charts and diagrams. 174 x 236mm. Published by Prentice-Hall Inc, 1981. ISBN 0-13-842922-7. Price \$21.50.

FORTH is a computer language which has attracted a lot of attention since its development by astronomer Charles Moore (who introduces this book) in the early 1970s. Generally those who have tried the language either love it or hate it — very few are lukewarm about Forth.

It would take more space than available to go into the details of the language here, and in any case that's what the book is supposed to do. It does it very well.

In 12 chapters, with four appendices, the book moves from introductory material, through reverse polish notation arithmetic to advanced topics such as

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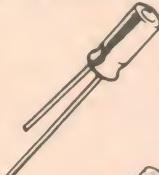
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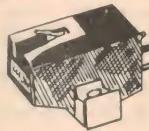
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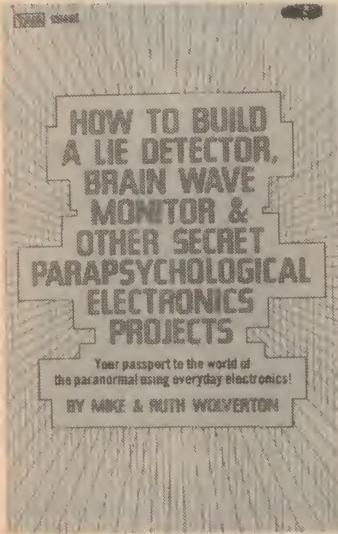
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the structure of the Forth compiler. Along the way the lessons are enlivened by cheerful cartoons which help the explanations in the text. Whether you are using Forth or thinking about it from a professional or hobbyist level, this book can be highly recommended as a very clear, readable introduction.

Our review copy came from McGills Authorised Newsagency, 187 Elizabeth St, Melbourne. (PV).

Lie Detectors



HOW TO BUILD A LIE DETECTOR, BRAIN WAVE MONITOR AND OTHER SECRET PARAPSYCHOLOGICAL ELECTRONICS PROJECTS by Mike and Ruth Wolverton. TAB books, 1981, Soft covers 127mm x 210mm, 308 pages, illustrated with diagrams and charts. Price \$14.95. ISBN-0-8306-1349-8.

Sub-titled "Your passport to the world of the paranormal using everyday electronics", this book discusses the use of electronics in probing those human capacities which are as yet unrecognised by conventional science.

In 10 chapters, with an appendix on "The Basics of Electronics", the book covers telepathy, communications with plants, biofeedback, psychokinesis, human energy fields and acupuncture, dowsing, Kirlian photography, UFOs and "Raudive voices", those ghostly voices which some claim can be recorded on an unattended tape recorder.

Each chapter contains a number of electronics projects, such as strobe lights (supposedly to assist in achieving telepathic trance states) brainwave monitors and galvanic skin response (GSR) devices (popularly called "lie detectors"), devices for locating infrared "hotspots" on the body which correspond to the acupuncture points of Chinese medicine etc. If you want to

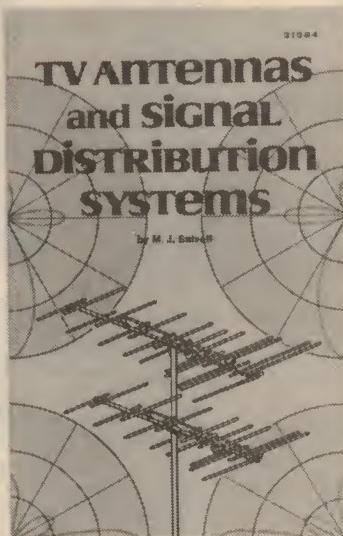
know how to build a Kirlian photography equipment, or a "UFO detector", then this is the book for you.

While we can't comment on the efficacy or otherwise of the devices described, it does appear that the circuit for the brain wave monitor circuit for example, as shown, has insufficient gain and discrimination to be capable of its stated purpose. Other devices, such as that for demonstrating the invisible heat energy of human beings are more effective — since this one consists of a bent drinking straw balanced on a pin.

In summary, the book is a bit of a patchwork with some parts excellently explained and others long and repetitious discussions of previous work such as the section on "pyramid power". If the book does serve a useful purpose, though, it is in bringing together so many odd facts (?) and information, and providing the means and the inspiration for the experimenter to follow up the authors' work.

Our review copy came from McGills Authorised Newsagency Pty Ltd, 187 Elizabeth St, Melbourne.

TV Antennas



TV ANTENNAS and SIGNAL DISTRIBUTION SYSTEMS, by M. J. Salvati. Published 1979 by Howard W. Sams Inc, Indianapolis. Soft covers, 217 x 137mm, 256 pages, illustrated with photographs and diagrams. ISBN 0 672 21584. Price \$14.75.

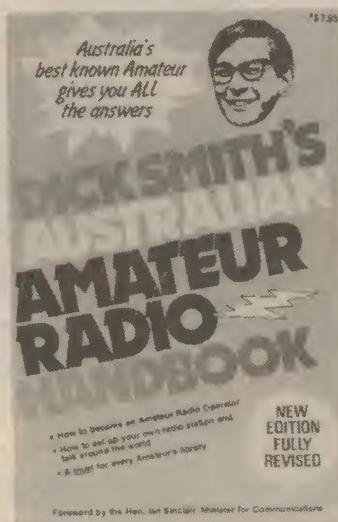
This book is basically a survey of the television antenna market in the USA. As such, the discussion in each chapter centres on typical commercially available antennas in that country. The same can be said of hardware such as masthead amplifiers, baluns, splitters and related equipment.

Even so, much of the content of the book applies to Australia as the general principles are the same and many of the

antennas discussed, whether for VHF or UHF, are very similar to models available in Australia.

In summary, this text is not of much use if you are interested in designing and building your own antennas but is otherwise sound in principles and well written. Our copy came from Jaycar Pty Ltd, 125 York Street, Sydney. (LDS).

Survey of Amateur Radio



DICK SMITH'S AUSTRALIAN AMATEUR RADIO HANDBOOK. Edited by S. Voron & D. Deger. Revised edition published 1982 by Horwitz Publications, Sydney. Soft covers, 211 x 134mm, 208 pages, illustrated with photos and diagrams. ISBN 0 7255 1200 8. Price \$7.95.

While this tome is titled as a handbook it really cannot be regarded as a useful reference for an active amateur radio operator. There is almost no theory at all. If it was to be regarded as a useful reference or a text it would have to feature sections on principles of radio communication, different types of RF modulation, radio circuits such as superhets and TRF receivers, antenna principles and so on.

It would be more correct to regard the book as a general survey of the amateur scene which is intended for anyone curious about this hobby. As such, it is a useful and easily read text which is sure to interest many a young and not-so-young reader. Sample chapter headings are as follows: What is Amateur Radio, Licensing requirements, Getting Started on the Airwaves, Accessories for the Shack. There are 15 chapters plus appendices.

Not surprisingly, the book is available from Dick Smith Electronics (LDS). ☉

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Shortwave Scene



by Arthur Cushen, MBE

Radio for the Print Handicapped opens in Hobart

Following the success of 3RPH Melbourne, 7RPH Radio for the Print Handicapped is now operating in Hobart on 1620kHz for six evenings a week.

The opening of 7RPH was observed on Saturday June 26, and since then their transmissions have been received each evening except Sunday. The broadcasts are on 1620kHz using 500 watts and a 40 metre tower carries the antennas on top of Mt Nelson. The station is aimed at those who have reading problems, and operates Monday to Friday 0700-1200UTC and Saturday 0700-1400UTC. The address is Radio for the Print Handicapped, GPO Box 1393P, Hobart, Tasmania 7001.

The opening of 3RPH on 1705kHz has stimulated an interest in a reading service for those who are blind or visually handicapped. This type of service is widely used in the United States. The sub-carrier of an FM transmitter is used and the material for the blind listener is received on a special converter which enables information to be picked up which would not be available to the normal listener.

Radio for the Print Handicapped in Melbourne, 3RPH operates on 1705kHz and is heard on a similar schedule to 7RPH, while two other stations, 2RPH Sydney, listed for 1750kHz and 4RPH Brisbane 1760kHz, are planned.

Basically the programs are the reading of newspapers and other spoken information and a special broadcast of interest to the disabled, with few items of recorded music.

Melbourne station 3RPH has a program for the radio minded listener on the first Thursday of each month when Peter Walsh is heard with his radio enthusiasts program at 1230UTC. The address of 3RPH is: 7 Donald Street, Prahran 3181, Melbourne.

DENMARK'S NEW SCHEDULE

Following the initial broadcasts from Copenhagen, Denmark on their new 50kW transmitter, some frequency changes have been made.

The transmission to Australia has been retimed to 2200-2255UTC and is now on

15165kHz. The other transmission at 1100-1155UTC remains on 25850kHz. A new frequency, 11825kHz, is now scheduled which could be changed to 11860kHz for the broadcast to Greenland and the Pacific 0100-0155UTC. The frequency of 17770kHz is used at 0900-0955, 1000-1055 and 1300-1355UTC. All other broadcasts are on 15165kHz and are broadcast at 1630, 1800, 1900, 2000, 2030, 2100, 2200, 2300 and 0000UTC, all for 55 minutes except the transmission at 2030 which lasts for 20 minutes. The station will send a colourful verification card, a painting symbolising the Danish national anthem "There is a lovely land".

The Danish 50kW transmitter is situated in Herstedvester some 25 kilometres from Copenhagen. Two 500kW transmitters are planned to be ready for use around 1985. The address for reception reports is, The Voice of Denmark, 1999 Copenhagen, Denmark.

NEW VOA CHANNELS

The Voice of America was reported last month as operating on several out-of-band channels and information on the location and power of these transmitters has now been received from Washington.

The broadcasts on 9840kHz originate from the Greenville transmitter site in South Carolina and use 500kW with broadcasts in English at 0500-0700UTC to Europe. Broadcasting in French to Africa from 0500-0630 and to Europe from 1500-1800 is on 15880kHz; 0400UTC to Eastern Caribbean and South America; 21840kHz also uses 50kW from Greenville and broadcasts to Europe from 1200-1600UTC.

LIBERIAN SIGNAL

For many years ELBC, operating on 3255kHz, was the only Government station in Liberia, but in recent years ELWA Monrovia is more widely reported.

The reception of Monrovia signals on 3255 have been reported in Australia and New Zealand. Listening in the afternoon in New Zealand reception has been possible from around 0500UTC when programs are in the local dialect, continuing with music up to 0558UTC. Station identification is given in English and then follows some commercials with news in a local language at 0600. During the program there is several identification signals and a rooster crowing is frequently heard.

Listeners in Australia are hearing the transmission at 2100UTC when English is broadcast on the frequency, including a news bulletin.

SOUTH AMERICAN NEWS

ARGENTINE: Radio Argentine External Service has retimed its English news bulletin and this is now heard 2230-2300UTC on 11710kHz. Three other bulletins are heard on this frequency, at 0100, 0230 and 0430 and each program is 30 minutes in duration. During the recent conflict in the South Atlantic, Radio Liberty was heard over a period of 2 months on 17740kHz with programs beamed to the British Fleet, but this station has now ceased operation.

BOLIVIA: Radio Riberalta listed on 4697kHz has been heard on 4710kHz closing at 0415UTC. The station should also be heard opening at 1100UTC on this new frequency. On the adjacent channel of 4730kHz Radio Abaroa was received with a broadcast running past 0430UTC.

NICARAGUA: The Voice of Nicaragua continues to be received on 5950kHz with broadcasts up to closing at 0600UTC. The complete schedule is 0200-0600, while in New Zealand the medium-wave frequency of 620kHz has also been received.

PERU: Radio JSV, Jesus Americo Santa Cruz Valencia, is a new station heard on 6065kHz opening 1030UTC. According to a verification letter received by a member of Radio Nuevo Mundo in Japan, the station manager states that

the power is 5000W and that the antenna is a 12 metre dipole. Radio JSV is located in Huanuco.

VENEZUELA: A new regional short-wave service has been noted on 9640kHz, the transmitter is 50kW and the address is R. Nacional, Ap. 80567, Caracas. According to the WRH Newsletter, La Voz de Venezuela is expected to operate shortly with 2500kW transmitters on 1240kHz medium-wave.

The time signal on 6100kHz YVTO is well received throughout this area during our evening listening. The station broadcasts from Caracas and gives time announcements and identifications in Spanish and is best around 0800UTC.

RADIO NEW ZEALAND

At the end of March the Short-wave Service of Radio New Zealand was faced with closure when the Government withdrew \$180,000 subsidy to keep the transmission in operation. Since then the Short-wave Service has continued with funding from the Broadcasting Corporation of New Zealand. This has meant that only the National Program is relayed on Shortwave, and special material such as "Arthur Cushen's DX World" which was broadcast for 22 years has been temporarily ended. A tentative schedule for broadcasts from September 5 has been issued; To the Pacific on 11960kHz at 1800-2115UTC; 15485kHz at 1800-2115, and 0830-1215UTC and 17705kHz at 2130-0815UTC. To Australia on 11960kHz 0830-1215UTC and on 15485kHz at 2130-0815UTC.

NEWS FROM QATAR

A new frequency is now in use by the Qatar Broadcasting Service, which is using 17910kHz at 0900-2100UTC. Other transmissions are on 15505kHz at 0245-1000 and 9570kHz 0245-1600UTC.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT. In areas observing daylight time, add a further hour.

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New Products...

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We test the "Musolink" FM wireless guitar link

Neat and compact, the "Musolink" FM wireless guitar link can be clipped onto the guitarist's belt. It enables an electric guitar to be used with an FM tuner up to a range of 50 metres.

Those readers familiar with rock and roll music will be aware that guitarists often incorporate quite energetic stage movements into their performance. In fact, some guitarists' antics can best be described as frenzied. If that fits your requirements for guitar playing, then the mobility allowed by a wireless link will no doubt appeal.

Musolink can be used with any FM receiver capable of tuning from 88-108MHz, and allows an electric guitar to be used without trailing leads. It comes housed in a sturdy metal case fitted with a spring steel clip so that it can be attached to the player's belt. The antenna - a 40cm length of flexible wire - hangs at the guitarist's side.

The only control is an on/off switch and this is fitted to a recessed panel at one end of the case so that it cannot be accidentally bumped. An adjacent LED provides power on/off indication, while an RCA input socket accepts the guitar signal. Power is normally provided by a 9V battery, although a rechargeable NiCd battery can also be used.

If a NiCd battery is used, it can be recharged via a 3.5mm jack socket at the opposite end of the case, adjacent to the antenna outlet. Also provided is a screwdriver slot adjustment which enables the transmitter output frequency to be adjusted over the domestic FM band. Some caution should be exercised in this respect however, as tuning to a broadcast station frequency will result in interference.

We tested the Musolink and found that it performed satisfactorily with both portable FM radios and more elaborate FM stereo tuners and receivers. However, while the carrier signal strength is typically sufficient to give a maximum reading on a signal strength meter, the modulation depth could be greater. Generally, it is necessary to turn the volume control up to quite a high level in order to achieve sufficient sound output from most stereo receivers.

In use, the transmitter did not appear to affect the quality of the guitar sound in any way. Frequency response also appeared to be satisfactory, with the pro-



"Musolink" FM wireless guitar pick-up.

viso that it is necessary to strike the higher notes quite firmly to achieve satisfactory volume. This is due to the fact that the smaller diameter strings used for the higher notes are not able to modulate the signal as efficiently. As a result, it is unlikely that the user would be able to achieve any over-modulation ("fuzz") type distortion. Whether this is a disadvantage or not will depend on your preference in music.

"Musolink" retails for \$149.50 and is available from Jaycar Electronics, 125 York St, Sydney, 2000.

Kit for radioteletype modulator/demodulator

GFS Electronic Imports now has available a radioteletype modulator/demodulator which can be supplied either as a fully assembled printed circuit board or as a kit.

The MDK-17 terminal unit offers LED indication for easy tuning of received signals, 10 ports for all combinations of TTL and 20-60mA send/receive connections, and an open collector output for direct keying of HF transmitters.

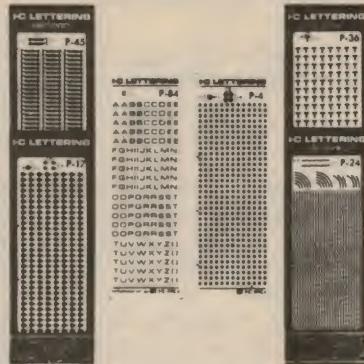
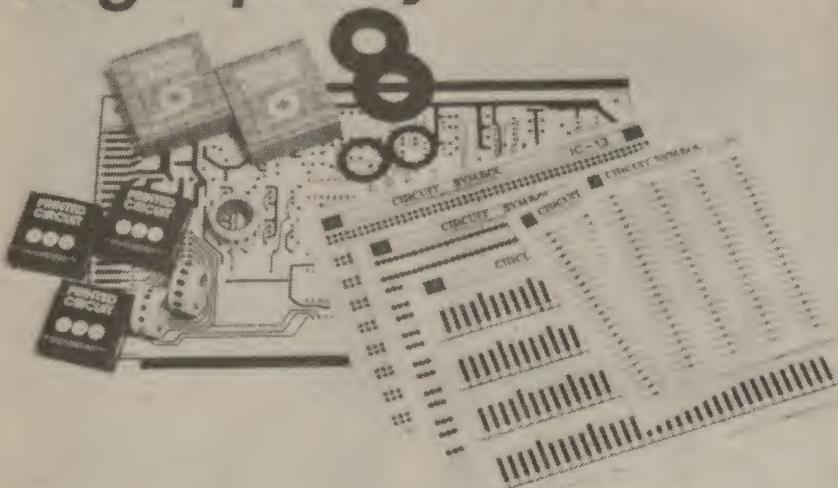
Both HF and VHF amateur and commercial use is supported, at baud rates of 45 to 50 and a shift of 170Hz. Other baud rates and shifts can be accommodated with some component changes.

Cost of the unit is \$145 assembled and tested or \$95 for the kit, both plus \$5 postage and packing. For additional information contact GFS Electronic Imports, 15 McKeon Rd, Mitcham, Vic.



MDK-17 radioteletype terminal unit comes as a kit or fully assembled.

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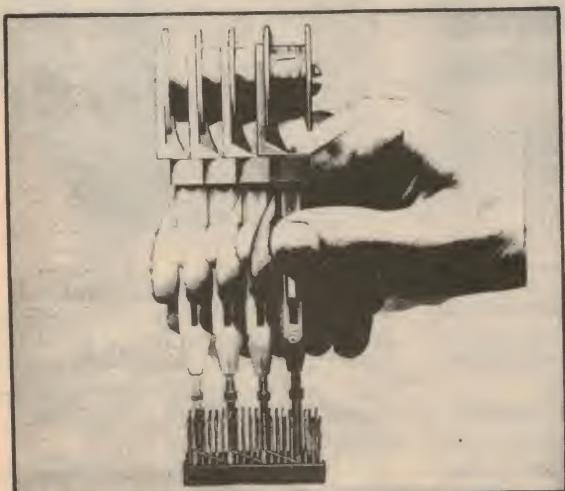
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 JW-1-R RED 50 FOOT ROLL & JUST WRAP TOOL

New Products

Modem eliminator for local networks

A new Modem Eliminator series offering selectable speeds up to 614,400bps has been released by Professional Australian Systems of Thornbury, Victoria.

The Modem Eliminators permit the direct connection between terminals and computers giving substantial annual savings on medium and high speed modem rentals.

The PAS Modem Eliminator regenerates send and receive signals, and has been designed for communication channels where clocks are required for synchronous working, at speeds up to 614,400 baud. It is available as a rack-mounted system of up to seven channels, as a single channel unit, or as an integral part of PAS's Mini Rack system.

Each channel provides buffered Tx and Rx data, transmit and receive clocks, "request to send", "clear to send", "carrier detect", "data terminal ready" and "data set ready" signals. Adjustable delay settings range from 8ms to 500ms between RTS and CTS. The clocks to both computer and terminal have selectable transmission speeds of settings from 300 baud to 614.4 kilobaud through a switch on the front panel.

Front panel indicators provide an instant visual display of activity on the link. Input and output signals are via standard 25-pin female D connectors and single and multiple systems are double insulated from the 240V/50 Hz power supply.

For more information contact Professional Australian Systems, 883a High Street, Thornbury, Vic, 3071.

"Super bright" LEDs now even brighter

Following on the heels of their success with "super bright" LEDs with a luminous intensity of 200 millicandela (see EA, May, 1982), Stanley Electronics has announced the development of LEDs with a luminous intensity of 500mcd at 20mA, claimed to be the brightest available.

In addition to their use where high brightness is required, the Stanley LEDs can be used in place of normal indicators, requiring a fraction of the current for the same light output.

Super bright LEDs are available from stock from Soanar Electronics Pty Ltd, 30 Lexton Rd, Box Hill, Vic, 3128.

Options enhance Databar code reader



A number of enhancements and optional features are now available for the Databar Model 401 Bar Code Reader. The reader was the first of a range of Australian designed and manufactured Bar Code readers released last year (see EA, July, 1981).

A 16-character alphanumeric display is available as an option, showing the last symbol scanned. The display may be addressed by the host computer to give the operator prompt messages, feed-back information or echo transmitted data as verification. The display uses 18-segment LED characters.

A numeric keypad may be fitted in addition to the display to provide the choice of key entry or bar code entry.

Characters are displayed as keys are pressed and may be transmitted to the computer in similar format to a bar code message. Data are prefixed with a character identifying bar code or keypad entry.

The basic reader has been upgraded to now support Codabar, Code 39, 2 of 5 or APN Bar Codes. Multiple code operation, with automatic selection, or other bar code formats can be provided on special order. Data transmission rates now extend from 110 to 9600 baud, with a protocol allowing up to 16 readers to share a single serial I/O port.

For more information contact Norton Instruments, Box 995, GPO Sydney, NSW, 2001.

Power line conditioner from Warburton Franki



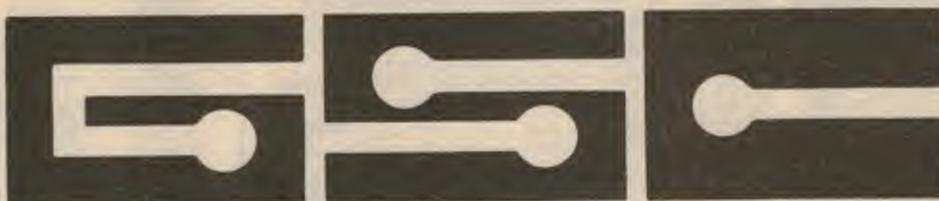
Warburton Franki now has available the Topaz Series Z frequency converters, designed to convert the frequency of available AC power to a fixed 50Hz, 60Hz or 400Hz output.

The converters provide frequency stability, output voltage regulation and noise isolation, reducing input voltage variations of up to +8% and -13% to

within 1% of the nominal value.

Topaz Series Z frequency converters are available from stock in power ratings from 200VA to 2000VA. All models feature overload and short circuit protection and a choice of automatic or manual restart.

For more information contact your local Warburton Franki office.



for bread-boarding and test equipment

Recently, an extensive study was conducted by an independent research organization on what product qualities most influence professionals in their choice of electronic instruments. Know what they said?

Lower price. Small more compact packages. Simpler operation. Which is exactly what our product philosophy has always been. But that's no co-incidence!

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More than a half million customers worldwide have chosen GSC products over any other. We have gone to a lot of trouble to build our reputation, and we are proud of our success.

That is why we think it is worth your time to take a closer look at the GSC products now available in Australia. They have proven our philosophy time and again.

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ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

MOVE OVER HEATHKIT

Yes, we all know that the world's best selling Electronics Kits are from HeathKit — and with good reason — great design, premium quality components, comprehensive step by step instructions etc. Well, we've taken a leaf from their book with our new range of kits and while an ALTRONICS kit may cost a dollar or so more — just check the benefits to you, the enthusiast constructor, premium grade semis such as Philips, Fairchild and Motorola, full easy to follow assembly instructions and every last nut and bolt supplied — even solder! So when you buy one of these kits you can do so with confidence. Cheers... *Jack O'Donnell*



DIGITAL FREQUENCY METER

See Electronics Aust. Mag. Dec. 81-Feb. '82
500 MHZ, 7 DIGIT RESOLUTION PLUS
PERIOD MEASUREMENT FEATURE



IMPORTANT NOTES:

(1) This project is well within the scope of the "not so experienced" as virtually all components are contained on a single PCB.
(2) **ALTRONICS USE ONLY THE SPECIFIED INTERSIL LSI — BEWARE OF INFERIOR KITS THAT DO NOT CONFORM TO THE ORIGINAL DESIGN.**

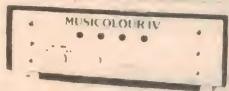
* Pre-punched and screened front panel, no drilling or filling required. * Bright high efficiency 7 segment display. * Frequency ranges 0-10MHz, 0-50MHz, 10-50MHz (with optional pre-scaler). * 4 gating times — 0.1, 1, 10, 100 seconds. * 4 period measuring ranges 1'00, 100 and 1000 input cycles give 0.1us resolution. * High input sensitivity — 10mV to 30MHz. 100mV at 50MHz @ 1M input impedance. 200mV at 50MHz @ 75 ohms input impedance. * High accuracy — typically better than .005% count uncalibrated.

Costs a fraction of commercial counters.

EXCLUSIVE ALTRONICS KIT FEATURES:

* IC sockets provided throughout.
* Low aging 10,000 MHz XTAL.
* Thermally heatsink for 5V regulator.
* Quality Pacted Instrument Case
K 2500 (50 MHz version) \$119.50
K 2501 Pre-scaler \$26.00
(add for 500 MHz version)

* THE EVER POPULAR * MUSICOLOUR IV EA PROJECT



Combination Colour Organ and Light Chaser. Four channel colour organ. Internal microphone or connect to speakers for colour organ operation. (The lights connected to each channel pulse in beat to the music proportional to portion of frequency spectrum concerned.) Four chaser modes forward and reverse. Output lamp load capacity a massive 2400 watts — that's 100 party globes. Full instructions and every last nut and bolt included. Great for parties, shop signs, display windows etc. K 1004 \$79.50

ETI 145 PROTOTYPER

A versatile project combining a number of useful pieces of test equipment on the one PCB. The unit is self contained and features:
• 3 power supplies, +5V @ 150MA, -5V @ 18MA and a variable supply + 1.25V to 10V @ 100MA.
• Variable multivibrator 3Hz—600Hz.
• 6 buffered indicator LEDs.
• 1 negative and 1 positive going pulse indicator.



This unit may be used for "prototyping" and designing both digital and analogue circuits without the usual mess of power supplies, oscillators etc. hanging left, right and centre. The ALTRONICS KIT comes as specified by ETI and includes 1C sockets and all hardware.
• Genuine Intersil 7660 precision voltage converter 1C used.

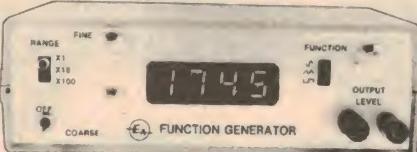
★★★ SPECIAL BONUS ★★★

THE ALTRONICS KIT INCLUDES A VERSATILE POWER SUPPLY KIT IN LIEU OF THE PLUG PACK SPECIFIED.
HANDY 12VDC and 9VAC

K1145. ONLY \$69.50

BANKCARD JETSERVICE-DELIVERY NEXT DAY

FUNCTION GENERATOR WITH DIGITAL DISPLAY

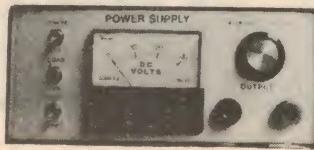


EA's new Function Generator covers the frequency range from 15Hz to 170kHz in three ranges with coarse and fine frequency controls. An economical 4-digit display has been incorporated to eliminate dial calibration. Sine wave distortion can be trimmed to around 0.5%. See EA April, 1982

K 2505 \$79.50

ALTRONICS POWER SUPPLY

BASED ON EA LM 317K PROJECT
Every workshop, school and hobbyist
should get one now!



* Overload and short circuit protected.
* Full voltage and current metering.
* 3-32 volt output at 1 AMP.
* Uses LM 317K variable regulator.
* Full instructions and every last part included.

VALUE PLUS!

K 3200 \$39.95



DIGITAL CAPACITANCE METER

Electronics Australia Project. Measures 1PF — 99,999 UF. 240V Mains Powered. Bright LED Display. Easy to build. Complete kit of parts and full instructions.

*** EXCLUSIVE TO ALTRONICS ***
Each kit now includes precision measured capacitors for accurate calibration of each range.

K 2520 \$45.00

DUAL TRACKING POWER SUPPLY



+ 1.3 to + 22V @ 2 AMPS + 5V @ 0.9 AMPS

Unit is fully protected against short circuits, overloads and thermal runaway. Pos and Neg supplies track within 1MV, voltage adjustable to within 10MV.

- Uses .25% linearity 10 turn pot.
- High sensitivity meter.

Essential for every school, workshop and lab.
Easy to build!

K 2507 \$86.00

See Electronics Australia March 1982

GREAT NEW MOSFET PA AMPLIFIER KIT FROM ETI 150 watts power output.

See June '82



UNCONDITIONALLY STABLE - SOUND STUDIO SPECIFICATIONS

OUTPUT IMPEDANCE Selectable to low Z voice coil or 100V or 70V line out.

INPUTS 2 mic inputs HI or low Z with speech filter.

1 Aux. Input.

* Low noise 5534 op amps used.

* Noble W/wound resistors used in output stage for guaranteed stability.

*** ALTRONICS EXCLUSIVE ***

All due respects to ETI, but we felt the original case was lousy — So we've brought out ours utilising our snazzy H 0400 Black Rack Cabinet.

It looks terrific! And for this month only, it's the same price as the original version.

K 5035 ONLY \$239.00

GO ANYWHERE 240V PWR. KITS

See EA May and June '82. These great new inverter kits enable you to power 240V appliances for your car, caravan or boat. (From Standard 12V car battery.)

40 WATT

Suits small appliances, i.e. turntable, tape deck, shaver etc. Variable frequency adjustment enables accurate speed control of turntable motors.



IC Sockets Provided

K 6700 \$55.00

300 WATT

Fully regulated and overload protected XTAL locked frequency.

NOW USING HIGH EFFICIENCY C-CORE TRANSFORMER

Use to power hi-fi, TV sets and for emergency lighting.



• Gold plating on both PCB edge and edge connector.

• Low age rate parallel resonant XTAL used.
• Sockets for all IC's.

K 6750 \$199.50

\$10 DELIVERY ANYWHERE
IN AUSTRALIA!

ALTRONICS

For Address, Phone No. and Despatch details see our Double Page Advertisement pages 10/11

BANKCARD JETSERVICE-DELIVERY NEXT DAY

New Products

Kit makes complete synthesiser voice board

NRG Electronics now has available a complete kit for a low cost music synthesiser voice board, the 82/02. Once assembled the board provides all necessary circuitry to form the heart of a fully fledged synthesiser.

The NRG voice board provides all the basic features found in commercially available synthesisers, including two voltage controlled oscillators, a 24dB/octave low pass filter and two four-part envelope shapers.

All variable functions including pitch and pulse width of the VCOs, cutoff frequency, resonance of the filter, and attack, decay, sustain and release parameters are voltage controlled for easy connection to external controllers, sequencers and computer controlled digital to analog converters.

Eight switch inputs select waveforms for the two voltage controlled oscillators, oscillator synchronisation and intermodulation. The oscillators are scaled for a standard response of one octave per volt and a 10-octave range is possible. The voice boards can be connected in parallel for a multi-voice system.



NRG synthesiser voice board kit can be used with a keyboard or computer control.

A 14-page instruction manual is supplied with the kit, with full assembly and setting up procedures.

For further information contact NRG Electronics, 135 Rae St, North Fitzroy, Vic, 3068.

LED bar-graph display from Datel Intersil

Recently released by Datel Intersil (USA), the DBM-20 level meter and controller is a panel mounted 20-segment red LED bar display. It accepts DC or slowly varying AC signals and converts

them to digital form for display as a progression of lighted LED segments in a bar graph format.

The display unit can also control external circuits, as it provides a TTL compatible output which can be wired from any LED to a rear panel connector. Internal pads are provided for circuits such as a DIP relay controller or a driver IC supplied by the user.

Input voltage range is from +0.1V to +2.4V full scale. The meter has an instant response with no overshoot, and can be used in either bar or dot modes.

Further information is available from Elemeasco Instruments Pty Ltd, PO Box 30, Concord, NSW, 2137 or offices in other states.

GEC Australia Ltd to represent Marconi

Marconi Communication Systems has appointed GEC Australia Ltd sole Australian representative for all products manufactured by its England-based Broadcasting Division.

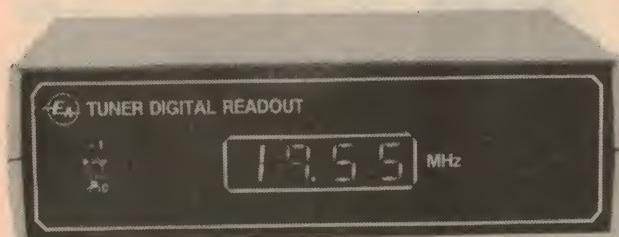
GEC Australia will represent Marconi through GEC Electronics and GEC Control and Automation Divisions.

Marconi produces a comprehensive range of sound and television broadcasting units.

For more information contact GEC Electronics, 2 Geffnock Ave North Ryde, NSW, 2113.

Coming Next Month ***

Digital Readout for AM tuners



Suitable for use with most AM tuners, this digital readout covers both the broadcast band and the shortwave bands to 30MHz. Resolution is 1kHz for all frequencies and display update time is 0.2s.

**ON SALE:
Wednesday, October 6th**

Fluorescent Starter

Held over from the September issue, this solid state starter eliminates blinkety-blink turn-ons. All the parts are housed in a standard starter case so the light wiring does not have to be modified.

Speech Synthesiser

If your computer has a Centronics printer interface it can use this Voice Synthesizer which is based on the Votrax phoneme system. That means that it does not have a set vocabulary but can be programmed to say anything you want to hear!

PLUS: an article on distribution systems for TV receivers and VCRs.

* Our planning for this issue is well advanced but circumstances may change the final content. However, we will make every attempt to include the articles mentioned here.

Tap the SOUL of your instrument with the fantastic C-ducer



RHC005

By sticking a flexible tape microphone onto your acoustic instrument, you can 'shape' the sound according to your taste before using tone controls. You can actually create a personal sound.

You have a choice of preamplifiers too. A C-ducer Gigster which clips onto your belt and plugs into a stage amp/mixer, or a C-ducer Professional unit for studio and high quality stage performance.



For professionals, semi-professionals or the serious amateur or simply anyone who wants to bring out the real soul of their acoustic instrument - the C-ducer flexible tape microphone is for you.

R.H.Cunningham
PTY LTD

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4-8 Waters Rd, Neutral Bay, N.S.W. 2089. Ph: 909 2388. Telex 21707

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HANDHELD MODELS

	Tx Ex \$	Tx Paid \$
8020B	210.00	238.48
8021B	165.00	187.38
8022B	155.00	176.02
8024B	265.00	300.94
Case	15.00	17.03

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DIGITAL MULTIMETERS



BENCH MODELS

	Tx Ex \$	Tx Paid \$
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8012A	375.00	425.86
8050A	415.00	471.28
Case	40.00	45.43

(8010A & 8012A only)

Case	55.00	62.46
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Note:

Handheld DMM's include battery, test leads, instruction manual, pocket-size operator's card and certificate of calibration.
Benchtop DMM's include line cord, test leads, instruction manual, and certificate of calibration.

COME AND SEE US NOW!

MAIL ORDERS TO: RADIO DESPATCH SERVICE

869 George St., Sydney 2000

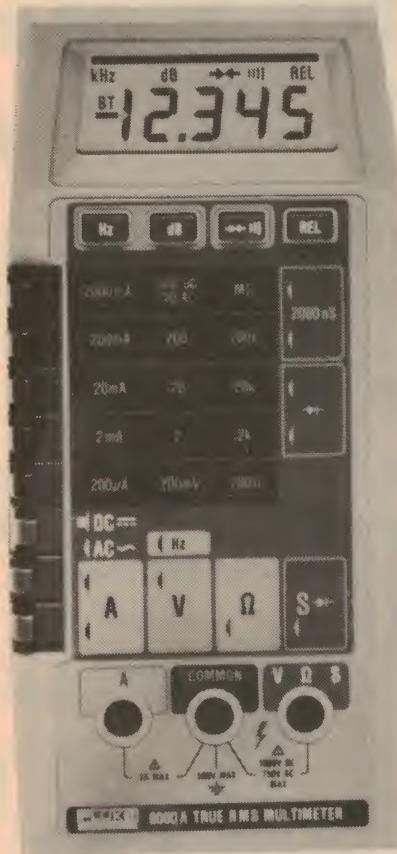
Phones: (02) 211 0191 • 211 0816



New Products

New 4½ digit Fluke multimeter

The Fluke 8060A handheld multimeter is a microcomputer based 4½-digit instrument which features, in addition to standard functions, true RMS measurements for signals up to 100kHz, frequency measurements up to 200kHz, resistance ranges to 300MΩ, and the ability to store any measurement as an offset (a positive or negative relative reference value).



Continuity testing (with a selectable audible or visual indication), conductance, and constant current source diode testing are also included, together with the display of any voltage measurement in dBm referenced to 600Ω, or relative dB.

A multiplexed LCD display provides a special function indicator, low battery warning and a self-diagnostic display. The 8060A is powered by a standard 9V alkaline battery, providing 170 hours of continuous operation, or by an optional AC power supply.

Also available is the Fluke 8062A, a companion model without frequency, dB and conductance functions.

Fluke multimeters are distributed by Elmeasco Instruments Pty Ltd, 15 Macdonald St, Mortlake, NSW (PO Box 30, Concord, NSW, 2137).

World market for new Philips mobile



Australian based manufacturer Philips Telecommunications Manufacturing Company Pty Ltd has designed and developed a new range of "state of the art" mobile transceivers for the world market.

Called the 900 Series, the range has been developed around a microcomputer which controls a single loop synthesiser, replacing the conventional crystal. The microcomputer also controls the main circuit elements of the mobile transceivers, allowing provision of specific customer requirements by programming an EPROM rather than by hardware additions.

The 900 Series includes three main units; the 91 dash mounted pushbutton control module linked to a trunk mobile, the 92 dash mounted control module for connection to an extended control mobile and the compact 93 dash mounted transceiver.

Top of the range is the 91 mobile, with 120 channel capacity, intended for use by police, customs, security forces etc. It features an exclusive "intelligent" muting circuit which greatly extends the usable range of the transceiver.

Options available for the model 91 include selective call, duplex opera-

tion, status and identification, automatic vehicle identification and continuous tone squelch.

The model 91 control unit is said to be very easy to operate, with illuminated touch sensitive controls and an eight digit LED display which indicates the channel selected, mode and transceiver status, mute and transmitter power output level and other pre-programmed messages.

The model 92 is a 40 channel system, tailored for small to medium capacity systems. The use of a frequency synthesiser means that multi-channel use can be provided by reprogramming an EPROM rather than by substituting crystals.

Manufactured at Philips' Clayton plant in Victoria, the 900 series mobiles have already attracted overseas inquiries for manufacturing licensing agreements. As General Manager of Philips-TMC Mr Ian McKenzie says; "We have designed them for the world market. They meet European, American, Canadian and Asian approval requirements as well as the Australian regulations."

For further information contact Philips-TMC, Clarinda Rd, Clayton, Vic 3168.

Cadin/Clift Electronics instrument case

A new instrument case, model I/C-1, moulded in impact resistant ABS plastic is now available from Cadin/Clift Electronics Pty Ltd. Features of the new case include stylish rounded corners and internal provision for a variety of PCB mounting positions.

Internal slots are provided for recessed mounting of front and rear panels, and two blank panels of easily cut styrene are included with the case. PCB mounting hardware and self adhesive rubber feet are also provided.

Dimensions are 132mm x 129mm x 38mm, making the case ideal for small instrumentation applications.



For further information contact Cadin/Clift Electronics, P.O. Box 33, Ringwood East, Vic 3135. Phone (03) 870 0684.

**NEW STORE
opening October
in Carlingford**

AT CARLINGFORD COURT NEXT TO KENTUCKY FRIED CHICKEN

JAYCAR- for hard to get Semiconductors

WE NOW STOCK HUNDREDS MORE IC's THAN MOST OF OUR COMPETITORS AT
THE BEST PRICES AROUND

CMOS

4000	Dual 3 Input NOR Gate
4001	Quad 2 Input NOR Gate
4002	Dual 4 Input NOR Gate
4006	18 Stage Stebe Shift Register
4007	Dual Complementary Pair Plus Inverter
4008	4-Bit Full Adder
4009	Hex Buffer (Inverting)
4010	Hex Buffer (Non-Inverting)
4011	Quad 2 Input NAND Gate
4012	Dual 4 Input NAND Gate
4013	Dual D Flip Flop
4014	8-Stage Static Shift Register
4015	Dual 4-Bit Static Register
4016	Quad Analog Switch
4017	Decade Counter/Divider
4018	Resettable Divide-by-N
4019	Quad AND OR Select Gate
4020	14 Stage Binary Counter/Divider
4022	Divide-by-8 Counter Divider
4023	Triple 3-Input NAND Gate
4024	7 Stage Binary Counter/Divider
4025	Triple 3-Input NOR Gate
4026	Decade Counter 7-Seg Output
4027	Dual JK Flip Flop
4028	BDC to Decimal Decoder
4029	Presettable Up-Down Counter
4030	Quad 2 Input EXCLUSIVE OR Gate
4031	64 Stage Static Shift Register
4032	Triple Serial Adder
4034	8 Stage TRI STATE Universal BUS Register
4035	4 Bit Shift Register
4036	Triple Serial Adder (Negative Logic)
4040	12 Stage Binary Counter
4042	Quad Clock-D Latch
4045	Micropower Phase-Lock Loop
4047	Low Power Mono/Astable Multi
4049	Hex Inverting Buffer
4050	Hex Buffer (Non-Inverting)
4051	8 Channel Analog Multiplexer
4053	Triple 2 Channel Analog Multiplexer
4055	Quad 4 Input NOR Gate
4066	Quad Analog Switch
4067	1-of-16 Analog Switch
4068	8 Input NAND Gate
4069	Hex Inverter
4070	Quad 2 Input EXCLUSIVE OR Gate
4071	Quad 2 Input AND Gate
4073	Triple 3 Input AND Gate
4075	Triple 3 Input DR Gate
4076	Dual D Flip Flop
4077	Quad 2 Input EXCLUSIVE NOR Gate
4078	8-Input NDR Gate
4081	2-Input AND Gate
4093	Quad 2-Input NDR Schmitt Trigger
4411	Decade Counter 7 Seg Output
4426	Decade Counter 7 Seg Output
4500	Triple Gate
4502	Strobed Hex Inverter
4503	Hex 3 Stage Buffer (Non Inverting)
4508	Dual 4-Bit Latch
4511	BDC to 7 Seg Decoder/Driver
4512	8 Channel Data Selector
4514	4 to 16 Line Decoder/4 Bit Latched
4517	Dual 64 Bit Static Shift Register
4518	BDC Up Counter
4520	Dual Binary Up Counter
4526	Programmable 4-Bit Binary Counter
4528	Dual Mono Multi
4538	Dual Mono/Precision Multi
4543	BDC to 7 Seg Latch/Decoder/Driver/LCD
4553	3 Digit BCD Counter
4557	1 to 64 Bit Variable-Length Shift Register
4581	4 Bit
4582	Look Ahead Carry Block
4584	Hex Schmitt Trigger
74C02	Quad 2 Input NDR Gate
74C04	Hex Inverter
74C14/40106	Hex Schmitt Trigger
74C922	16 Keyboard Encoder



74LS TTL

40	74LS00 Quad 2 Input NAND Gate
35	74LS01 Quad 2 Input NDR Gate
48	74LS02 Quad 2 Input NOR Gate
40	74LS03 Quad 2 Input NOR Gate
38	74LS04 Hex Inverter
95	74LS05 Hex Inverter (oc)
100	74LS06 Quad 2 Input AND Gate
90	74LS07 Quad 2 Input AND Gate (oc)
35	74LS10 Triple 3 Input NAND Gate
70	74LS11 Triple 3 Input AND Gate
90	74LS12 Triple 3 Input NOR Gate
\$1.00	74LS13 Dual NAND Schmitt Trigger
95	74LS14 Hex Schmitt Trigger
50	74LS20 Dual 4 Input NAND Gate
\$1.20	74LS21 Dual 4 Input AND Gate
50	74LS27 Triple 3 Input NOR Gate
75	74LS30 8 Input NAND Gate
74LS31	Quad 2 Input OR Gate
1.25	74LS33 Quad 2 Input NDR Gate (oc)
28	74LS41 10 Decoder
1.18	74LS47 BCD to 7 Seg Decoder/Driver (oc)
35	74LS48 BCD to 7 Seg Decoder/Driver
\$2.20	74LS49 BCD to 7 Seg Decoder/Driver
90	74LS73 Dual JK Flip Flop with Clear
1.18	74LS74 Dual D Flip Flop with Preset & Clear
\$1.25	74LS75 4 Bit Bistable Latch
22.20	74LS76 Dual JK Flip Flop
74LS77	Dual JK Flip Flop
2.95	74LS83 4 Bit Full Adder
50	74LS84 4 Bit Magnitude Comparitor
\$1.00	74LS85 Quad 2 Input EXCLUSIVE OR Gate
1.95	74LS91 Decade Counter
1.65	74LS92 Divide by 12 Counter
70	74LS93 4 Bit Binary Counter
1.75	74LS94 4 Bit Shift Register
75	74LS107 Dual JK Flip Flop
75	74LS109 Dual JK Edge-Triggered Flip Flop
60	74LS112 Dual JK Edge-Triggered Flip Flop
95	74LS122 Dual Mono Nonresettable with Clear
1.75	74LS123 Dual Retrig Mono with Clear
50	74LS125 Quad BUS Buffer Tri-State (No enable)
80	74LS126 Quad BUS Buffer Tri-State (hi enable)
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New Products

"Sinadder" for noise and distortion tests

Products manufactured by the Helper Instruments Company are now available from Vicom International, including the "Sinadder 3" test instrument. This unit combines several related functions.

As an automatic distortion meter which includes an internal 1kHz generator, it measures SINAD sensitivity and gives rapid alignment. No frequency, null or level adjustments are necessary. A monitor loudspeaker enables you to listen to the audio output of beepers and other receivers where a loudspeaker may not be provided.

As an AC voltmeter, the Sinadder provides nine ranges from 10mV full scale to 100 volts full scale. It can be used to check audio circuits from microphone to loudspeaker levels. An internal audio amplifier and loudspeaker controlled by the range switch and a front panel potentiometer maintain proper sound level regardless of input.

Finally, as an audio signal tracer the instrument allows you to listen to audio in speech amplifiers and repeaters while measuring the level. Audio distortion can be tracked down and defective audio stages located. In addition, the 1kHz tone can be used as test tone for setting transmitter modulation and remote control volume levels.

For further information contact Vicom International Pty Ltd, PO Box 366, South Melbourne, Vic, 3205.

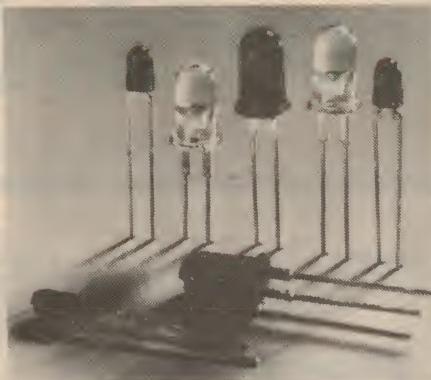
Low power digital panel meter

Datal-Intersil now has available a 4½ digit LCD digital panel meter offering balanced differential analog inputs and low power (15mW) circuitry.

The DM-4105 panel meter converts analog voltages from -1.9999V to +1.9999VDC to be displayed as decimal digits. The meter is auto-zeroed on each conversion cycle to eliminate zero drift. Power can be provided by 4 "AA" cells.

Additional features include prominent 12mm high digits and serial BCD outputs and digit drives available on the back panel of the meter. These outputs can be used for remote displays, or in conjunction with a demultiplexer, as inputs to a microcomputer or printer.

For further information contact Elmeasco Instruments, PO Box 30, Concord, NSW 2137 or their offices in other states.



High brightness LEDs from Philips Elcoma

Philips Elcoma has introduced a range of LEDs said to have an efficiency of five times that of conventional "Superbright" LEDs.

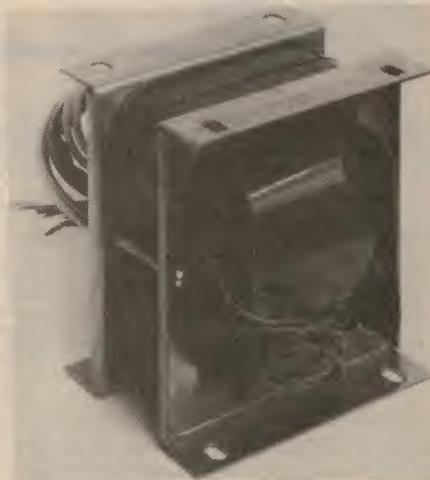
When driven at a current of 50mA the new Philips LEDs produce a light output of 500 millicandela, and can replace conventional light sources in illuminating dials and alarm switches. When driven at 10mA they are bright enough to be used for lighting panel switches and for normal indicators.

Three devices are available; the CQX24 narrow angle ultra-high intensity LED with a light output of 100mcd at 10mA, the CQW24 wide angle LED (15mcd at 10mA), and the miniature CQW54 wide angle LED, with a light output of 15mcd at 10mA.

For further information contact Philips Elcoma, 67 Mars Rd, Lane Cove, NSW, 2066.

Transformer designed for 300VA inverter

Selectronics, Australian designers and manufacturers of a wide range of transformers and custom wound coils, has announced the availability of a transformer to suit a 12VDC-230VAC, 300VA inverter.



Transformer designed for 300VA inverter.

The new X1159 transformer has been produced to meet the demand created by "a national project" according to the press announcement. See EA, June 1982 for details. It uses C core construction, resulting in a considerable reduction in size and weight over more conventional types.

Compared to traditional E and I types, C core construction also provides a marked increase in efficiency and lower idling current.

For further information contact Mr B. Scott, Selectronic Components Pty Ltd, 25 Holloway Drive, Bayswater, Vic.

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REVIEWS OF RECENT

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WOLF-FERRARI: "The Secret of Susannah"

WOLF-FERRARI — *The Secret of Susannah*. Complete Opera. Renata Scotto (soprano); Renato Bruson (baritone) with the Philharmonic Orchestra conducted by John Pritchard. CBS Digital Recording CBS 36733.

The name Wolf-Ferrari still sounds a bit contradictory. His father was German, his mother Italian. From his father he got his superb command of classical technique, after being sent to study in Germany. From his mother came the gift of Italian melody.

Although well-off, he was not lazy and, during the Edwardian and early Georgian period, turned out a mass of works. Today, he is mostly remembered by the little opera under review and a short string quartet. His "grand" opera, "The Jewels of the Madonna" was never produced and, at any rate, has a thoroughly distasteful story.

Susannah is one of the earliest of the verismo operas — operas written about everyday subjects — but with the setting and acting of realistic plays. In this instance, Susannah is an out of date little comedy with only two characters — if one excludes a mute servant — a jealous husband and a wife who secretly smokes. Whenever the husband smells tobacco, he thinks his wife has been entertaining a lover and flies into a rage.

It's a simple story — it was not called an opera by the composer, but an intermezzo — but there is delightful music in every bar.

Wolf-Ferrari's superb technique, particularly his orchestration, provides musicians with reason for constant admiration. It is always in perfect balance with the voice. In this case he is aided by the fine quality of the digital recording.

Wolf-Ferrari's music is often reminiscent of that of other composers, including some of his contemporaries but there is never a hint of plagiarism. His own personality remains intact. Indeed, Wolf-Ferrari might be suspected of paying them a compliment by quoting their



various styles. Yet the whole adds up, even today, to enchanting entertainment. I am surprised that it is not presented more often, coupled with another short opera such as Ravel's *l'Heure Espagnole*.

His characters wear clothes of the Edwardian period — the husband even a top hat which dwindles slightly towards the top, much like the period's caricature

of a Frenchman. How do I know? I saw it at Covent Garden as a kid and, even today, remember the fine baritone Sammarco in the part.

Although the digital technique does fine justice to the orchestra, it is not so kind to the voices. Its very extended range makes Renata Scotto's pleasing soprano rise to a Callas-like shriek in climactic passages. At the other end of the range is an important piano solo, supposed to be played in another room, that is just — and I mean just — audible. Baritone Renato Bruson is a useful contribution as the husband.

The little work is charmingly, if not always faultlessly sung, although there are no patches that could be justly labelled mediocre; at worst an occasionally forced note.

I cannot finish this review without paying my deepest respects to the Philharmonic Orchestra's exquisite playing under John Pritchard. (J.R.)

TCHAIKOVSKY SYMPHONY — Or is it?

TCHAIKOVSKY — *Manfred Symphony*. London Symphony Orchestra conducted by Michael Tilson Thomas. CBS Stereo Analog SBR236028.

Almost ever musician knows that Tchaikovsky wrote six symphonies. The last three still survive as lustily popular items on concert programs and in record catalogues.

Actually, he wrote seven but *Manfred* is not usually included because it has a program. I mean by this that it describes events and actions in musical terms. Nevertheless, Tchaikovsky himself called it a symphony and it gave him much trouble to write.

It has just occurred to me that Richard Strauss, in addition to his unmistakably labelled Tone Poems — "Don Juan", "Don Quixote", "Death and Transfiguration" and others — still called some of his symphonic works by name — "Domestic

Symphony", the "Alpine Symphony" and so on.

I suspect the first of these hybrids was Berlioz' "Harold In Italy", which is in symphonic form, although no mention of this is made in the title.

Of course, there had been symphonic program music before this — I can think of some as far back as Mozart — and what about Weber's "Konzertstück"? And Beethoven's "The Pastoral" comes pretty close to program music in many of its characteristics. By the way, it is odd to remember that Tchaikovsky regarded *Manfred* as his greatest "symphony".

First, the sound: The disc is in analog and, so beautifully recorded that it is difficult to imagine it acquiring any benefits from any other technique. Moreover, its dynamic range is very wide but, at its loudest, causes no discomfort.

It is easy to guess why, despite its appeal to its composer, this same enthusiasm is seldom felt by the public. Missing are the many whistable tunes

Reviews in this section are by Julian Russell (J.R.), Paul Frolich (P.F.), Neville Williams (W.N.W.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

you find in his other works, virtually through the whole of his output. Manfred lacks the fire and panache of the last three symphonies and any of the great ballets, although Thomas does very well in getting the most out of the material, without prettifying it. The irreproachable orchestral playing advertises Thomas' control.

Yet there still remains something "dutiful" about this score. And I cannot recall Tchaikovsky at any other time being inspired by metaphysics. Despite these unusual departures, not always to everyone's taste, I recommend its acquisition. I do so because of the excellence of its production and the opportunity it presents to round out one's knowledge of Tchaikovsky. No true collection can be complete without it. (J.R.)

A non-review — but still recommended!

GRIEG — Piano Concerto in A Minor.
SCHUMANN — Piano Concerto in A Minor. Claudio Arrau (piano) with the Boston Symphony Orchestra conducted by Colin Davis. Polyrecords Stereo 4579.

When I read back over what I had written, having listened to this record, I realised that I hadn't even mentioned it! I had simply been philosophising but maybe that's not a bad thing. So here's what I wrote:

Why, one might ask, another recording of Beethoven's Fifth or Brahms' Violin Concerto when these, and other works of similar character, have been recorded so often before, several of them superbly? At present those works are, of course also popular in the concert hall. Often they are already currently available in performances of varying merit to such an extent that the type in the English Classical Gramophone Catalogue has been reduced to a size that makes it necessary, on occasions, to use a magnifying glass to help decipher it!

And there are — or were — countless other performances that have had their day, been deleted and now found only in second-hand shops.

True, there have been shades of differences in some of the performances recorded during the last few years, an accent here, a tempo there, or even an overall conception by different artists. The newcomer is bewildered as to which to buy and usually follows recommendations by his favourite critic.

Among the latter performances are different, but still fine versions that appeal to one audience but not to others. Some prefer a strictly orthodox style, others

FANFARES: Stop, look and listen!

FANFARES, Including "Fanfare For The Common Man" (Copland). The London Philharmonic Orchestra, conducted by Jorge Mester. Stereo, Varese Sarabande digital VCDM 1000.240. From PC Stereo, Pty Ltd, PO Box 272 Mt Gravatt, Qld 4122. Phone (07) 343 1612.

According to the jacket notes, the term fanfare normally "denotes a short passage for trumpets as is performed at coronations and other state ceremonies. In England, they are known as 'Flourishes' and date back to the 17th century."

This particular recording owes much to (Sir) Eugene Goosens who, in 1921, founded a contemporary music paper in London, and through its pages, invited prominent musicians to compose fanfares, which he undertook to present in the Queen's Hall at contemporary music concerts.

Much later, in the period 1931 to 1946, and as resident conductor of the Cincinnati Symphony Orchestra, he renewed his interest in the fanfare form and commissioned 19, mainly from American composers, which he included in his concerts.

Many of these fanfares — about 20 in all — have been recorded for this album, some for the first time. Included are fanfares by Copland (3), Hanson (2), Harris, Cowell, Wagenaar, Gould (2), Taylor, Bernstein (3), Fuleihan, Thompson, Piston (2), Creston, Goosens. Each one is titled, of course, and the notes outline

are more lenient. One can sympathise with the record companies' many problems and can admire their enterprise in finding something new to tempt buyers — improvement in sound, stereo, quadraphonic, digital and the latest, PCM encoded. All have their day and, over the years, enthusiastic musicians must have collected goodness knows how many different performances of the same work. But I often wonder how many times they play them!

During the period when steel needles were supposed to ruin shellac 78s, the Gramophone Magazine made a survey as to how long a 78 could be played this way without significant deterioration. The result was round about 30. I am writing of course about serious music.

In those days, the average buyer would possibly play his new acquisition every night or so for a while, then once a week, later once a month and then it might stay on his shelf for months, silent and neglected. In the meantime fans



briefly the background to each composition.

There is information also on conductor Jorge Mester.

By nature, the fanfares are quite short, varying from as brief as a half-minute to five minutes at most. As such, the fanfares are simply what they are — a collection of attention-arresting miniatures, with no cohesion in other than definition, and adding up to about 40 minutes of orchestral sound.

Why then purchase the album?

Two reasons suggest themselves: the first, to study the style and content of fanfares, as a student of music.

The second: to feed the signal through a modern hi-fi system, and to relish the detail of the orchestra, the blare of brass and the pounding of the timpani and percussion. And I mean "pounding": your woofers will wonder what's going on!

The sound, recorded in St John's Church, Smith Square, London, has been preserved by a Sony PCM 1600 digital system, a Neumann lathe and cutter, Technics turntable and Teldec vinyl.

Another sound spectacular, even if it is made up of 20 separate miniatures. As to your personal reaction, I'd be guessing. (W.N.W.)

would agonise desperately with substitute styli — dried thorns, bits of bamboo and other material calculated to play a record undamaged long past the time its owner had lost interest in it!

This brings us to the question of how should music be played. The answer, of course, is how it sounds best to the listener. There is often a tendency to standardise on one particular version and only the smallest deviation from this version is permitted. In other instances some bold spirit will depart successfully from this interpretation.

And this is what makes the version under review so attractive to me. Since Debussy's crack about Grieg's music being like snow wrapped in pink paper — or something like it — it has been the fashion to treat most of his music as if it were miniature; in other words "prettify" it. These two artists do just the opposite. They expand it.

Those with long memories will recall how Julius Katchen and Charles Macker-

RECORDS & TAPES — continued

George Golla on Cherry Pie audiophile

GEORGE GOLLA. Audiophile stereo, Cherry Pie LA-37718. (Distributed by Festival).

George Golla certainly had a large hand in the production of this album, as the composer of the music, the arranger and a performer of as many as five guitar parts; this with the aid of a Philips multi-track PRO 71 tape recorder.

But he also had some notable supporters in the person of Don Burrows (playing flute, alto flute, bass flute and alto sax), John Sangster (vibes and percussion), Ed Gaston (bass), Alan Turnbull (drums), plus other named musicians on violins, violas and cellos. And who better to consult and contribute to the jacket notes than Eric Jupp?

There are 10 tracks on the album, all of them melodic, very listenable and pleasantly varied in style and arrangement: Somewhere Nice — Algeciras — N.P. Blues — For Her — Study In C — Little Spanish Love Song — Blower — Te Amo — In Vain My Love — Over And Out. The jacket notes contain a couple of lines on

ras did much the same thing with marked success in the Sydney Town Hall, many years ago.

Arrau and Davis treat both the works — yes, the Schumann too — not as chamber pieces or works to be contested by competitors at not-too-advanced piano competitions — but with true symphonic proportions. It would be unnecessary in the case of the majority of readers of this column to praise these great artists, except to say that they are at the top of their form and that buyers will find in their playing a refreshing change from whatever they have at present on their shelves. Highly recommended. (J.R.)

☆ ☆ ☆

NIELSEN — Symphony No. 4 London Symphony Orchestra conducted by Ole Schmidt. Unicorn Stereo recording released for members of the World Record Club. RO94220.

I think I am safe in predicting that, despite Nielsen's enormous popularity, especially during the 1960s, the situation is unlikely to be repeated in the '80s.

My reason for so saying is Nielsen's lack of true melody. It's not often you can go home whistling a tune — or even a scrap of one — that you just heard during one of his works. There are some, of course, but most of his works lack the morsels to catch the modern ear — especially those



each title, by way of comment and mentioning the instrumental line-up used.

Additional notes, which many will find interesting, explain the four types of guitar used: the Classic Guitar, the Acoustic Plectrum Guitar, the Electric Guitar, and the Solid-Body Electric Guitar. Incidentally, to read these notes, printed in small gold type, you will need a good light.

But to get back to the music: as I said earlier, it is tuneful and listenable and, even if you don't recognise all of those numbers, you'll soon get to know them.

Technically the sound is good, perhaps a little bass-heavy, but I did wonder whether the amplitude would be a bit too much for cartridges which are short on compliance. (W.N.W.)

which have survived the enthusiasm for Sibelius, Strauss, Vaughan Williams, early Stravinsky and so on.

Nielsen's Fourth Symphony has four movements but all are played without pause. The first movement starts with great energy which it expends on its journey to the second subject. What strikes one forcibly, and pleasantly at first, is the constant change of keys — not in the smooth Straussian technique of leading you there gently but in Nielsen's case abruptly.

I must admit that some of Nielsen's changes are delicious and could set a new fashion, but others shock without convincing the listener. I readily admit, though, that there are not many composers who understand writing for the woodwind as Nielsen does and this produces some enchanting moments.

In the second movement especially, Nielsen seems more interested in the use of keys than in passion or meditation. Towards the end of the whole work there is a final brawl between the timps and rest of the band. It would need a referee to name the winner! (J.R.)

For information on World Record Club albums, contact the club at 605 Camberwell Road, Hartwell, Victoria, 3124. Tel. 29 3636.

ORGAN FAVOURITES FROM BLENHEIM PALACE. Nicholas Danby. Stereo, World Record Club, WRC R-06187.

This is not a new or modern organ. Completed in 1891, it is going on for 100 years old and, according to the jacket notes, has remained tonally untouched since it was designed and constructed by "Father Willis" for the eighth Duke of Marlborough and uncle of the late Sir Winston Churchill.

Nor is this a new recording. I was fairly certain that I had listened to it before but was nevertheless unprepared for the notation on the label: 1968!

But those factors notwithstanding, it is an album that I thoroughly enjoyed. The EMI/Columbia recording is very clean and well balanced, with outstanding dynamic range. The Willis organ is notably and intrinsically "musical" and the acoustics of the Long Library of the Blenheim Palace complements it to perfection — at least as far as the recording is concerned. The reverberation can be heard but it is not long enough to blur the flow of the music. And Nicholas Danby, a distinguished organist and musical academic, lets the music flow, free from personal flamboyance.

The selections are "chestnuts" for sure but they remain so because organ buffs seem never to tire of them:

Toccata and Fugue in D Minor (J. S. Bach); Trumpet Voluntary (Clarke); Suite Gothique, four movements (Boellmann); Toccata from Symphony No. 5 (Widor); "Nimrod" from Enigma Variations (Elgar); Scherzo from "Dix Pieces" (Gigout); Choral No. 3 in A-Minor (Franck).

You may already have these selections on other albums but, unless this one is entirely irrelevant on that account, it would be a good investment. (W.N.W.)

Australian ballads



AUSTRALIAN BALLADS, The Early Years. Seona McDowell and Folk Musical Group accompaniment. Stereo, Folkways Records FS-37335. APA Promotions, 43 Barter Crescent, Forest Hill, Vic 3131. Phone (02) 878 3953.

Folk ballads can all too easily end up at either of two extremes: camp fire style, with rough, nasal voices, which I find off-

putting, no matter how "authentic" the sound; either that or formal choral, completely out of keeping with the original spontaneity of the songs.

Seona McDowell, an Australian artist currently based in the USA, is poised comfortably between these two extremes. An accomplished musician and vocalist, she has a pleasant voice and manner, and accompanies herself, so the notes point out, "with six and twelve string guitars, five string banjo and Appalachian autoharp".

Additional instrumental and vocal colour is provided by a group of bluegrass musicians — a reminder that this "Australian" album was indeed produced in Cleveland, Ohio, for release on the American Folkways label.

The program of ballads is divided into six groups: Convicts (Convict Maid, Botany Bay, etc); Explorers (Lady Franklin's Lament); Gold Rush (Cross of the South, etc); Bush-rangers (The Wild Colonial Boy, etc); The Shearers (Click Go The Shears, etc); Pioneers (Waltzing Matilda, etc).

Seona McDowell's diction is good but, in any case, the words are set out in full on an inner brochure. Apart from normal domestic listening, the album may well be of special interest for use in schools where Seona once used to lecture and sing in person.

The technical quality is well up to normal standards. (W.N.W.)

MALE CHOIR—DEVOTIONAL



WONDERFUL LOVE. London & Home Counties Festivals of Male Voice Praise. Conductors: John Ablewhite, John Philips. Stereo, Word WST 9587. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135.

Mention of the Festivals of Male Voice Praise is likely to stir in one an expectation of the massive and magnificent sound of massed choirs in the Royal Albert Hall. In fact, this is a much smaller group — twenty-seven voices — typical of the smaller associated groups which minister in cathedrals, mission halls,

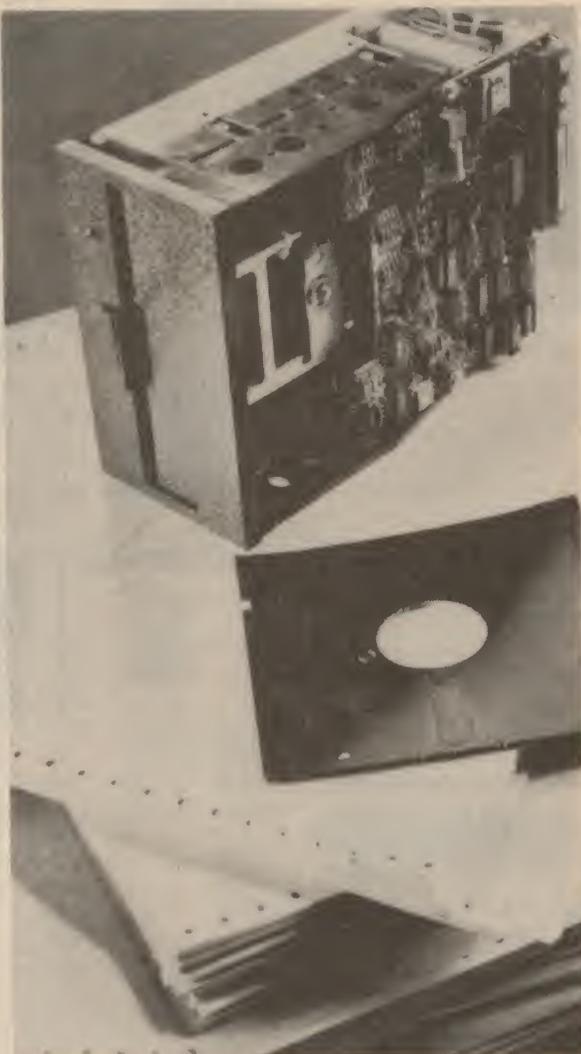
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ITOH 8300 SERIAL	\$730 + TAX
ITOH 1500 PARALLEL (DAISYWHEEL)	\$1515 + TAX
ITOH 1500 SERIAL (DAISYWHEEL)	\$1555 + TAX
ITOH 8510 PARALLEL	\$910 + TAX
ITOH 8510 SERIAL (GRAPHIC ETC)	\$1015 + TAX

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+5V reg 10a 16V unreg @ 1A
KIT \$79.95 inc
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7 Slot Motherboard \$90.00
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Build a working DPM in ½-hour with these complete evaluation kits.

Test these new parts for yourself with Intersil's low cost prototyping kits complete with A/D converter and LCD display (for the 7106) or LED display (for the 7107). Kits provide all materials including PC board, for a functioning panel meter ICL7106EV (LCD).

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S100 gold plated wire wrap	\$8.50
S100 solder tail	\$6.90
D2 Motorola bus	
43/B6 solder tail	\$8.50
43/86 gold plated wire wrap	\$11.50

10 TURN POTENTIOMETERS

Stock resistance values

50R, 100R, 200R,
500R, 1K, 2K, 5K,
10K, 20K, 50K,
100k

Spectrol model 534 ¼" shaft.
Price 1—9 \$9.90
10 + values may be mixed \$9.50



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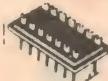
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40 pins \$5

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MICROCOMPUTERS

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8V @ 10A x 15V @ 1A \$28.50
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20 TURN CERMET TRIM POT



SPECTROL 43P ACTUAL SIZE

STOCK RESISTANCE VALUES
10R, 20R, 50R, 100R, 200R, 500R, 1K,
2K, 5K, 10K, 20K, 50K, 100K, 200K,
500K, 1M, 2M
1—9 \$1.50
10—99 \$1.40
100 \$1.10



CERMET SINGLE TURN TRIM POT

Spectrol model 63P
ACTUAL SIZE

STOCK VALUES
10R, 20R, 50R, 100R, 200R, 500R, 1K,
2K, 5K, 10K, 20K, 50K, 100K, 200K,
500K, 1M, 2M

1—9 \$1.00
10—99 0.90
100 0.80

Values may be mixed.

DIP SWITCHES SPST

P/N	No of Switches	Price
SD3	3	\$1.60
SD4	4	1.70
SD5	5	1.90
SD6	6	2.30
SD7	7	2.40
SD8	8	2.50
SD9	9	2.70
SD10	10	3.00

DIP SWITCHES SPST



16 Pin Zip* Dip 11 \$11.50
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*Zero Insertion Pressure

Hexadecimal Keypad \$29.50



19-key pad includes 1-10 keys ABCDEF and 2 optional keys and a shift key.

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Model 21 1.8" dia \$16.50
Model 16 9" dia \$12.50
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PART NO	DESCRIPTION	1-9	10-25	25+
DE-9P	9 PIN MALE	\$3.50	\$3.50	\$3.10
DE-9S	9 PIN F/MALE	4.50	4.20	3.90
DE-9C	9 PIN COVER	2.20	2.10	1.90
DA-15P	15 PIN MALE	4.50	4.20	3.90
DA-15S	15 PIN F/MALE	5.10	4.90	4.70
DA-15C	15 PIN COVER	2.30	2.10	2.00
DB-25P	25 PIN MALE	5.90	5.60	5.10
DB-25S	25 PIN F/MALE	6.90	6.60	6.10
DB-25C	1 pc Grey Hood	2.40	2.20	2.00
DB-25C2B	2 pc Black Hood	2.80	2.70	2.50
DB-25C2G	2 pc Grey Hood	2.70	2.50	2.40
DC-37P	37 PIN MALE	7.90	7.50	7.10
DC-37S	37 PIN F/MALE	10.90	9.90	9.10
DC-37C	37 PIN COVER	4.90	4.50	4.10
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Post & Pack \$2.50 small kits, heavier kits add extra postage.

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AD0162-T15	\$13.03
AD0162-TB	\$13.77
AD210-SQ8	\$42.00
AD2160-SQ8	\$45.00
AD2161-SQ8	\$33.46
AD10100-W8	\$52.72
AD12100-HP8	\$85.10
AD12100-M15	\$79.11
AD12100-M8	\$79.11
AD12200-W8	\$53.99
AD12250-W8	\$83.00
AD2273-T8	\$59.00
AD4060-W8	\$5.03
AD5060-SQ4	\$19.06
AD5060-SQ8	\$22.05
AD5060-W8	\$17.59
AD5061-MB	\$17.08
AD70601-W8	\$22.00
AD70620-M8	\$21.54
AD70630-M8	\$20.78
AD70650-W8	\$26.96
AD7066-W8	\$26.96
AD80601-W8	\$20.24
AD8061-W8	\$20.24
AD80652-W8	\$26.20
AD8066-W4	\$27.66
AD8081-M8	\$9.81
AD9710-M8	\$41.11
ADF1600-8	\$19.44
ADF500-4500-8	\$19.44

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10-99 100+

IN4001	6c	5c
IN4002	6c	5c
IN4004	7c	6c
IN4148	5c	4c
IN5404	30c	25c
IN5408	35c	30c
IN4007	12c	11c

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High Thermal Capacity Black Anodised

1-4	5-9	10-49	50-99	499	plus
\$	\$	\$	\$	\$	\$
HS1 - 38mm	1.85	1.75	1.50	1.35	1.00
HS2 - 75mm	3.00	2.90	2.50	2.00	1.50
HS3 - 150mm	5.80	5.40	4.90	3.80	2.90
HS4 - 225mm	8.10	7.60	7.10	5.90	4.50
HS5 - 300mm	8.90	8.40	7.90	6.50	4.90

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HS11 - 38mm	1.40	1.20	1.00	0.90	0.80	0.70
HS12 - 75mm	2.50	2.20	1.90	1.60	1.25	1.20
HS13 - 150mm	4.90	4.50	4.00	3.20	2.45	2.40

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TDK ADC60	1 for \$3.60	10 for \$26.00
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TDK ADC120	1 for \$5.40	10 for \$46.50

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"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.



September 1932

Television: The BBC began regular television sessions. These were based on Baird's 30 line mechanical system, and were transmitted in the broadcast band, outside normal radio program hours. But there was considerable doubt as to the future of TV. "Until experience has been gained... it would be rash to offer definite conclusions; but it is not the opinion... that television... when developed... will revolutionise programs. There would not be automatic televising of every broadcast program."

☆ ☆ ☆

Televistor: John L. Baird announced a new televistor, for £25, for use with any good wireless set. It used a mirror drum in place of the old scanning disc, and a Kerr cell light modulator in place of the old neon lamp. It produced a 30 line picture 4in wide by 9in high, bright enough to be seen all over a normally illuminated room.

☆ ☆ ☆

Television in Australia: Mr A. V. Pickering announces that he is beginning television transmissions on 136 metres between 10.30 and 12.00 on Sunday evenings and from 11.30 to 12.00 on Wednesdays from his home at 11 Blair St, North Bondi.

☆ ☆ ☆

Army Signal Corps: Members of the Signals, 2nd Division, have constructed, during leisure moments, a complete shortwave transmitter and receiver, the standard military sets being designed for longer waves. The outfit operates on 51 metres, which has been allotted for military purposes, and may also be heard on the amateur spectrum as VK2SD. Communication has been established with most countries.



September 1957

Hearing aid: The first all-in-the-ear hearing to appear on the Australian market was announced. Produced by Sonotone of America, it was one of the first products of the then infant solid state technology. Much was made of the fact that it operated from a single mercury cell, developing 1.3V, which would power it for 50 hours at a cost of 3/6.

☆ ☆ ☆

Let's Buy an Argument: Readers were still arguing about the purpose and operation of post synchronising pulses in the TV signal, many being still not convinced by the explanations which had been offered in technical literature and at technical college courses, even though the discussion had been going on for months. There was also some sniping at TV salesmen who demonstrated sets using only token indoor aerials and the adverse impression of TV which this was creating. Also, many advertisers were claiming that the new 90° deflection tubes permitted a wider viewing angle than the 70° types they replaced. More argument.

☆ ☆ ☆

Spot wobble: Spot wobble was a popular theme at this time, being a technique developed to mask the line structures on TV screens, particularly where the (then) new large picture tubes were being introduced into countries employing low line standards. By wobbling the spot vertically the line was widened without degrading horizontal resolution. Originally achieved by means of an oscillator driving a coil around the tube neck, one manufacturer had just announced a special picture tube, with a split focussing grid, designed to eliminate the bulky and costly coil. In fact, little more was heard about spot wobble.



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OHIO SOFTWARE:	
K1 Hardware Catalogue (incl new boards)	\$1.98
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C4P, VIDEO BOARD (converts C1P Series 7)	\$130.00

COLOUR BOARD — C1P — Series 2	
H13A Short Kit, including documentation	\$35.00

H13B = H13A and tracks for 5v to 12v DC	\$39.00
H13A. Colour and RF out. Assembled and Tested	\$85.00

H13B = H13A Assembled and Tested includes 5v to 12v tracks	\$89.00
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OPTIONS:	
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SOUND — Parts Kit	\$2.50
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incl assembled and tested	\$18.00
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VIDEO — Parts Kit	\$2.50
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incl assembled and tested	\$15.00
---------------------------	---------

5v to 12v DC — No Kit available (Specialised)	\$24.00
---	---------

— incl assembled and tested	
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COMBINATIONS:	
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Sound and 12v assembled and tested	\$36.00
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Video and 12v assembled and tested	\$35.00
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All 3 mods (H13B) assembled and tested	\$45.00
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"H13B — Deluxe" — All mods assembled and tested (\$89 and \$45)	\$129.00
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Note: All prices include sales tax.	
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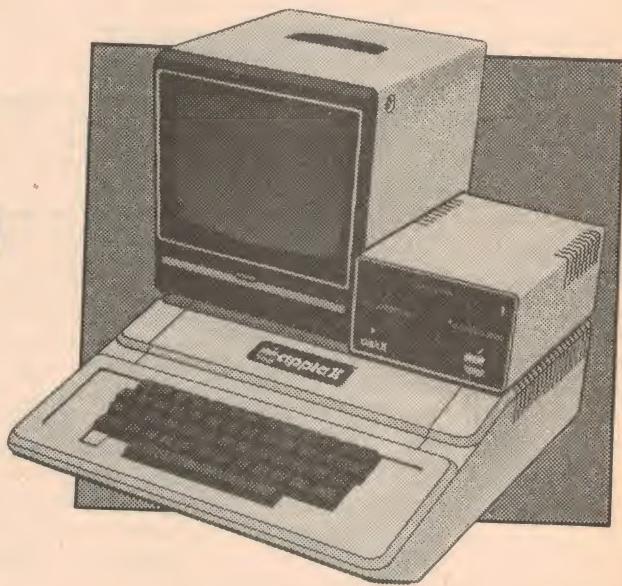
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A useful list for the computer enthusiast

Microcomputer club directory

Judging by the size of our microcomputer club list, computing is a very sociable hobby. Clubs can provide a wealth of information and advice, not to mention just plain fun. If you are thinking of joining a club there are quite a few to choose from, as our directory shows.

Queensland

IREE Microcomputer Interest Group:

PO Box 81, Albion, 4010.

All types

Super-80 Users Group (Brisbane):

Convenor Garry Gatfield, 165 Frasers Rd, Mitchelton, 4053.
Super-80

Queensland Sorcerer Users Group:

Secretary, 43 Stubbs Rd, Woodridge, 4114.
Exidy Sorcerer

Brisbane FORTH Interest Group:

3/10 Patricia St, Moorooka, 4105.

All systems running the FORTH language

Commodore Computer Users Group of Queensland:

Contact Mrs D. Dillon, Secretary, PO Box 127, Stones Corner, 4120.

Commodore systems

Superboard Users Group:

Ed Richardson

146 York St, Nundah, 4012.

Superboard

The Microcomputer Society:

PO Box 580, Fortitude Valley, Qld, 4006.

All systems.

Brisbane Youth Computer Group:

PO Box 396, Sunnybank, 4109.

All types

New South Wales

The Blue Mountains Computer Club:

Contact Eric Lindsay, 6 Hill Crest Ave, Faulconbridge, 2776.

All types

99/4 Home Computer Users Group:

Shane Andersen, PO Box 101, Kings Cross, 2011.

Branches in other states

Texas Instruments TI 99/4 home computer

Sorcerer Users Group:

PO Box 43, Peakhurst, 2210.

Exidy Sorcerer

Macarthur Computer Users Association:

c/- 109 Campbellfield Ave,
Campbelltown, 2560.

All types

Wollongong Computer Club:

PO Box 397 Dapto, 2530.

All types

Australasia ZX80/Microace Users Group:

87 Murphys Ave, Keiraville, 2500.

Sinclair and Microace

Newcastle Microcomputer Club:

PO Box 293, Hamilton, 2303.

All types

Microcomputer Enthusiasts Group (MEGS):

PO Box 3, St Leonards, 2065.

All types

Hunter Users Group — All Microcomputers (HUGAM):

PO Box 39, Broadmeadow, 2298.

All types

Apple Users Group (Sydney):

PO Box 505, Bankstown, 2200.

Apple II and III computers

NSW 6800 Users Group:

27 Georgina Ave, Keiraville, 2500.

DREAM 6800 and other 6800/6809 systems

Peach Users Group:

Cybernetics Research, 120 Lawson St, Redfern, NSW, 2016.

Hitachi Peach computer

Microace users group:

Contact Paul Willmott, 62 Alice St, Lakemba, 2195.

Microace

Sorcerer users Group:

PO Box E162, St James 2001.

Exidy Sorcerer

Ohio Scientific Instruments Microcomputer User Group:
NOTICE PO Box 250, Kingsford, 2032.
Ohio Scientific systems

Mawarra Super 80 Users Group:
Jim O'Grady, PO Box 1775, Wollongong, NSW, 2500.
Super-80

Compucolor Users Group:
The Logic Shop, 91 Regent St, Chippendale, 2008.
Compucolor systems

Sorcerer Computer Users of Australia (NSW Branch):
C/- PO Box 461, Ashfield, NSW, 2131.
Exidy Sorcerer

Commodore User Group:
GPO Box 4721, Sydney, 2001.
Commodore computers

Mi Computer Club:
Polly House, 55 Herbert St, Artarmon, NSW 2064.
All systems

80AT:
C/- Planet 3 Systems, 47 Birch St, Bankstown, 2200.
TRS-80, System-80 and other Z80 systems

Atari Computer Enthusiasts (NSW):
78 Ayres Rd, St Ives, 2075.

Atari 400/800

TRS-80 Color Computer

Ian Wotherspoon (02) 629 1076 is the national co-ordinator of a loose network of Color Computer users. Greg Wilson, PO Box 9, Potts Point, NSW 2011 distributes the magazine "Rainbow" for the TRS-80.

Australian Capital Territory

Australian ZX80 Users' Association:
19 Godfrey St, Campbell, 2601.

Sinclair ZX80

ACTARI:

Co-ordinator, ACTARI, PO Box E112, Canberra, ACT 2600.
Atari 400/800 systems

Sorcerer Computer Users of Australia (ACT Branch):
Contact Mr G. T. Dick, 31 Creswell St, Campbell, 2601.

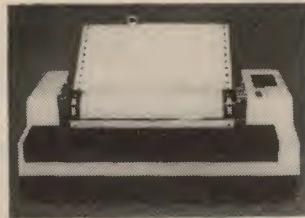
Exidy Sorcerer

Peach Users Group:

Mick Boesen 49 0339

Meets 7.30pm second Thursday of each month, Boulevard Business Services, Civic, ACT. Hitachi Peach

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A new book, "Software for the Super-80 Computer", will be available during September. Reserve your copy now.

This new book, presently at the printers, was compiled from submissions to the Super-80 Software Competition judged earlier this year. The book has 48 pages, of the same size as this magazine, featuring 17 Basic programs in printed listing form. They represent a useful range of exercises which will be of use to all Super-80 owners. The price: \$5 plus \$1 for postage anywhere in Australia.

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Microcomputer clubs directory

Australian Computer Society (Canberra branch)
Microprocessor Special Interest Group (MCSIG):
PO Box 446, Canberra City, 2602.

All systems

ACT Apple Users Group:

Jeff Brock, PO Box 1231, Canberra City, 2601.

Canberra Compucolor Club (CCC):

Jim Farquhar (062) 41 2870

Meetings at DEC offices, 28 Lonsdale St, Braddon, ACT.

Compucolor, Intecolor computers

Canberra Micro-80 Users Group

Bill Cushing, Urambi Village, Crozier Circuit, Kambah, 2902.

All Z80 based computers

OMEGA Ohio Scientific (ACT):

Geoff Cohen (062) 54 7608.

OSI systems

PET Users Group:

Greg Wilkins 512 3836.

Meetings at Scott House, 219 London Circuit, Civic, ACT.

Commodore PET

Hewlett Packard User Group:

Claire Maguire

121 Wollongong St, Fyshwick, ACT.

(062) 80 4244

Hewlett Packard systems

Victoria

Apple Users Society of Melbourne (AUSOM):
c/- 100 Chapel Rd, Moorabbin, Vic 3189.

Apple II and III

CP/M Data Systems (Formerly The Northern and Western Suburbs Computers Users' Group):

284 Union Rd, Moonee Ponds, 3039.

CP/M systems

ZX80 Users Club:

24 Peel St, Collingwood, 3066.

Sinclair ZX80

Computer Education Group of Victoria:

PO Box 245, Niddrie, 3042.

All types of educational computer systems

Super-80 Users Group:

Andrew Harding, PO Box 87, Glenhuntly, 3163.

Super-80

A.T. Microcomputer Club:

10 Sunbeam Rd, Ringwood East, 3135.

DGZ80 board, Microbee

FORTH Interest Group Australia:

Lance Collins, PO Box 103 Camberwell, 3124.

All systems running FORTH

Microcomputer Club of Melbourne:

PO Box 60, Canterbury, Vic 3126.

All types, special interest in TRS-80 and System-80

Ballarat Computer Users Group:

c/- PO Box 3, Ballarat, 3350.

All hobbyist systems

Sord M100 Users' Group (SMUG):

13 Stratford Square, Wantirna, 3152.

Sord systems

Mitsui Spectrum-11 Users group:

Greg McDonald, 17 Malvern St, Bayswater, 3153.

Spectrum-11 minicomputer

FORTH Interest Group:

FIG, PO Box 103, Camberwell, 3124.

All systems running FORTH

KAOS (Ohio Scientific):

David Anear, 49 Milliewa Cres, Dallas, 3047.

All Ohio Scientific systems

Burwood Users Group (BUG 80):

PO Box 46, Blackburn South, Vic 3130.

TRS-80 and System-80.

Geelong Computer Club:

PO Box 6, Geelong, 3220.

All types

OS/6502 Users Group:

Ian Eyles, 10 Forbes St, Essendon, Vic 3040.

Ohio Scientific and other 6502 systems

Peninsula Computer Club:

George Thompson, 3 Patterson St, Bonbeach, Vic 3196.

All systems

Compucolor Users' Group:

L. Ferguson, 12 Morphett Ave, Ascot Vale, 3032.

Compucolor

SCUA Sorcerer Computer Users (Australia):
PO Box 144, Doncaster, 3108.
Exidy Sorcerer

Tasmania

Tasmanian Small Computer Users Group
PO Box 474, Sandy Bay, 7005.

All types

Tasmanian OSI Users Group

David Tasker, 11 Bass Highway, Westbury, 7303.

Ohio Scientific

TAS-Micro:

Peter Deckert, Unit 1/456 West Tamar Rd, Riverside, Launceston 7250.

All systems

Tasmania Apple Users Club

PO Box 188, North Hobart, 7002.

Apple II and III computers

Tasmanian Electronics and Microcomputer Oriented Society (TEMOS)
John Stephenson, 4 Melina Place, Tarroona, 7006

All systems

South Australia

Adelaide Micro User Group:
36 Sturt St, Adelaide, 5000.

All types, with a newsletter published by users of TRS-80 and System-80 computers

South Australian Apple Users Club:

The Secretary, Cl- The Bookshelf, 169 Pirie St, Adelaide, SA, 5000.

Apple II and III systems

Sorcerer Users Group of South Australia:

Secretary, 22 Delange Ave, Banksia Park, 5091.

Exidy Sorcerer

South Australian Microprocessor Group (SAMG)

PO Box 113, Plympton, SA, Plympton, SA

All types

Compucolor-Intecolor Users of South Australia:

PO Box 86, Torensville, SA, 5031.

Compucolor and Intecolor systems

Commodore Computer Users' Association of SA

PO Box 60, Clarence Gardens, 5039.

Commodore computers

Western Australia

Perth TI-99/4 Users Group:

Bernie Elsner, PO Box 246, Mount Lawley, 6050.

Texas Instruments home computer

Sorcerer Computer Users of Australia:

Secretary, 90 King George St, Perth South, 6151.

Exidy Sorcerer

Western Australia Compucolor/Intecolor User Group (CUWEST):

C/- WAIT Computing Centre, Kent St, South Bentley, 6102.

Compucolor, Intecolor

Apple Users Club of WA:

PO Box 38, Willetoon, 6155.

Apple computers

The Western Australian Atari Computer Club:

Secretary PO Box 7169, Cloisters Square, Perth, 6000.

Atari 400/800 systems

Club for Peach Users (CPU):

Brendan Butcher (09) 367 5880

Secretary, 1 Charf Court, Riverton, WA, 6155.

Hitachi Peach and other 6809 systems

Perth '80 User Group:

C. Powell (09) 457 6849

Meetings first Tuesday of each month, 7.30pm.

TRS-80 and System-80 computers

Northern Territory

Northern Territory Microcomputer users Group:

H. Stockdale, 4 Bellara Street, RAAF Base, Darwin, 5789.

Meeting the first Sunday of each month, 96 Freshwater Rd,

Jingili, Darwin.

All types

Microcomputer Association of the Northern Territory:

Andy Smith, Darwin Community College, Casuarina, 5792.

Northern Territory '80 Computer User Group:

R. T. O'Brien, 433 McMillans Rd, Jingili, Darwin, 5792.

System-80 and TRS-80

New Zealand

Hawkes Bay Microcomputer Users Group:

580 Lowe Street, Hastings, NZ.

All types

Wellington Microcomputer Society Inc:

Lindsay Williams, 2 Pope St, Plimmerton, NZ.

All types

NZ Microcomputer Club Inc:

PO Box 6210, Auckland, NZ.

This club brings together Users' Groups from all over New Zealand, including Commodore, Apple, Tandy, CP/M ZX81, DREAM 6800 and OSI groups.

If your club doesn't appear here, or if (shock, horror!) the information given is incorrect, please help us by sending up-to-date information for our next club listing.

32K BYTES FOR THE ZX81

This board uses Dynamic RAM chips for lower cost and lower power consumption.

Simply plugs into the ZX81 expansion port offering 32K bytes for Basic programs and data handling. No extra PSU required. AMAZING!!!

Extra memory to help you build up your ZX81 into a powerful microprocessor system at an affordable price. Compare the price with other RAM PACKS available on the market!!!



**PRICE FOR 32K RAM PACK (RP 32)
ONLY: \$165 Incl. p & p (Australia)**

SEND ORDER TO:

VENDALE PTY. LTD., Dept. A7, P.O. Box 456,
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36 Plymouth St., Glen Waverley (03) 232 0444.

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Microcomputer News



IBM Personal Computer goes on sale in Sydney

The IBM Personal Computer has come to Australia months before it was expected. A Sydney company, Cybernetics Research, is taking orders for the basic IBM PC configuration, with deliveries three weeks after the date of order.

So great has been the demand for IBM's Personal Computer since it was released in the United States late last year that IBM has not yet launched the system outside the US.

Predictions are that IBM will sell 200,000 Personal Computers this year in the US alone.

Cybernetics Research is mainly aiming at equipment manufacturers and software developers who want to use the IBM computer before it is officially released here. They do not expect many personal buyers to be attracted by their terms — cash in advance and delivery in three/four weeks.

Cybernetics' price is not much above the US selling price. \$5,500 will buy the basic unit; processor unit, keyboard, one disk drive and green screen monochrome monitor with IBM DOS. A graphics option is a further \$520.

"What we have at the moment is the bare bones" said Cybernetics' Research General Manager Mr Richard Mills. "We are arranging supplies of software, and a service backup. The important thing is that we have the machine. We have been promised delivery in Sydney about three weeks from date of order and we are confident that this promise will be kept. We will, of course, be writing our own software for this machine — including Cyword, our word-processor, which is almost certainly the best word-processing system yet written."

"We are also looking at an Australian-

oriented accounts package, and a visual calculator".

Cybernetics Research are also NSW agents for the Hitachi Peach and the OKI if800, a self-contained Z-80 based system with colour graphics and a built-in printer.

In addition they can supply the Fairlight range of computers, manufactured in Sydney.

This range of dual 6809-based computers include the Qasar general purpose system and the Lightwriter, a dedicated word processor.

Fairlight are manufacturers of the CMI (Computer Musical Instrument) featured in the August issue.

For more information contact Cybernetics Research, 120 Lawson St, Redfern, NSW 2016. (PO Box 138, Chippendale, NSW 2008).

DREAM 6800 newsletter resumes publication

CHIP-8 received a big boost as a learner's language when EA introduced readers to a new computer design by Michael Bauer in May 1979. The advantages of the DREAM 6800 project were the experience gained in building a computer, the cost savings, and the power and ease of use of CHIP-8.

Since then the DREAM has gathered a large following — too large for the needs of enthusiasts to be met by EA. It would take the whole of the magazine to satisfy their thirst!

Rescue came in the form of Graeme Samways and Garry Nelson who formed the "NSW 6800 Users Group" and began publication of a newsletter. September 1980 saw the first of 18 newsletters, with regular subscribers growing to over 400. The standard of their work was so high that photocopies are in hot demand. Our thanks to Graeme and Garry.

Towards the end of its life the monthly magazine became known as the "DREAMER", and in issue 17 Ashley Emery of Beverly Hills made an offer to take over publication. Now "DREAMERS" newsletter No. 19 has been produced and distributed by Ashley with the help of Andrew Jack.

The first issue of "DREAMER" by Ashley

contains four CHIP-8 programs, two 6800 machine language programs and news and tips for users. Two programs of special interest are the monophonic organ using the keyboard to play tunes and the Auto phone dialer, with details of hardware and connections to be made.

Cost of the "DREAMER" is \$3.50 per issue or \$18 for six issues. To subscribe or to contribute material for publication write to Ashley Emery, 45 Ponyara Rd, Beverly Hills, NSW 2209.

Apple to move into Australia?

According to a report in the July 2 issue of Australasian Computerworld, Apple Computer Inc is set to take over the marketing of its products in Australia directly.

Rudi Hoess, managing director of the present authorised distributor, Electronic Concepts Pty Ltd, said recently that the new arrangement between his company and Apple "will possibly lead to the acquisition by Apple of the Apple elements of Electronic Concepts".

Few details are available at this stage, but it seems that the success of Electronic Concepts has inspired Apple to take a close look at the Australian market.

MicroByte — a range of software for the 2650

MicroByte (Software for the 2650) has sent us a copy of their latest newsletter, and it's an eye-opener! All you 2650 users who felt abandoned can take heart. MicroByte has a range of software for 2650 systems, including monitor/cassette operating systems, text editors and a new language.

A Disk Operating System will be available shortly, while an Assembler, Basic 3.0 and a text processing program are ready for delivery. The new language is Forth, a compact, fully extensible language whose users swear is the easiest and fastest language to program in. Many books are available describing Forth so we don't go into detail.

There are many varieties of 2650-based systems, either designed entirely by constructors or based on a published design. Most Microbyte software can be configured to run on any system, but if in doubt check with the suppliers first.

MicroByte is run by Ian Binnie and Martin Hood, and the latest newsletter does contain an explanation of why orders sometimes take up to six weeks for delivery. If you can bear with that find out more from MicroByte at PO Box 274, Belconnen, ACT 2616.

"Overall, we are very impressed with the Blue Label System 80. On a dollar per function basis it probably represents the best value around for a ready-built computer. Other systems can be bought for less, but ultimately they are not as powerful or as readily expandable as the System 80. There is also the matter of software, and here the System 80 really scores, with hundreds of compatible programs available for the TRS-80 as well as those specially written for the System 80."

Peter Vernon, Electronics Australia June '82

That's the new SYSTEM 80 BLUE LABEL

with features like:

- 16K memory (expandable to 48K with X-4020 Expansion Unit)
- Full upper/lower case video display capability
- Built-in speaker
- Built-in cassette deck with level control
- Works with any standard TV set or monitor
- Flashing cursor
- Huge range of software programs (compatible with most Tandy TRS-80 programs)
- AND LOTS MORE! Cat X-4005

NOW BACK IN STOCK!

EXPANSION UNIT

A BRAND NEW MODEL! - now with extra value!

The first row of 16K RAM is fitted as standard in this unit, with provision for an extra 16K (making the possibility of a HUGF 48K total memory). It provides as standard a floppy disk controller capable of controlling up to 4 single density disk drives. Significant changes internally include removal of the S-100 motherboard (now available as an option - see below). The Centronics port is still standard by the RS-232C interface and connector are now only available as options (see below). Cat X-4020

16K Expansion Pack

Don't be misled into paying extra for no better quality: ours are the premium quality 200ns type 4116 dynamic RAMS used by most microcomputers. Why not upgrade your computer? Pack of 8 4116 RAMS. Cat X-1186



\$399

\$29.95

S100 Interface Card

With this card you can open the way to many applications available via the S100 bus system. Cat X-4024

\$129.00

RS232C Interface

As an option with the expansion unit, the RS232C interface makes your computer capable of communicating with modems, or driving teleprinters or other serial printers. Cat X-4022

\$99.00

BARGAIN DISK STORAGE with the Dick Smith DISK DRIVES

Our disk drives go much further ... for so much less! They cost so much less than the Tandy Disk Drives and they incorporate a high quality MPI B51 drive mechanism together with matching built-in 240V power supply. Each drive has 40 track of storage capacity and is suitable for both double and single density recording. (With double density recording you can store more than 180K bytes per diskette!) They are suitable for use with most computers and disk controllers using the 34-way connection bus - such as the System 80 or TRS-80. (Don't pay their prices for disk storage!)



ONLY

\$419

Already configured for the two drives most users need: drive 0 (Cat X-4060) and drive 1 (Cat X-4061).

**AND YOU COULD WIN A DATSUN STANZA
BUT ONLY FROM DICK SMITH ELECTRONICS!**

SEE PAGE 98 FOR ADDRESS DETAILS

Read what EA have to say!



WAS NOW
\$750 ONLY \$690

SAVE \$60!

ALMOST HALF PRICE!

ORIGINALLY \$1495

NOW
ONLY

\$750

ALSO AVAILABLE DISK BASED SYSTEM 80 Mk II

When cassette operation is too slow and cumbersome for business operation, then this System 80 is the answer. The normal in-built cassette mechanism has been removed (even though we've allowed for external cassette connection) to allow for connection to a disk drive. We also added numeric keypad for extra fast finger input, and a special ROM program to allow for a flashing cursor on the screen for instant position recognition. Plus lots, lots more! Why not check it out at your nearest store right away! Cat X-4100.

ECONOMY GREEN PHOSPHOR MONITOR

If you're seriously into computers then this is the monitor for you. Provides a sharper, brighter image, and you avoid eye fatigue! Suited more for the professional rather than the hobbyist! Cat X-1198.

ONLY

\$199



DOT MATRIX PRINTER

ONLY **\$799**
WAS \$970

We've sold more of these superb printers than any other type. The Itoh B300P offers so many advantages over its competitors ... not the least being the price! It features high speed, bi-directional printing (125 ch. per second) with a full upper and lower case character set. It accepts standard fan-fold sprocketed paper, up to 240mm size (minimum 115mm) and so much more!

Each printer is supplied with a technical manual, a maintenance manual and is fitted with the standard 57N-36 input connector. Cat X-3255



DSE/A313.2/PAI

Microcomputer News

Computers Galore for business systems

Computers Galore, of Sydney, has acquired two new computer agencies, adding to their line-up of business computers.

Computers Galore opened last December as an Apple dealership, and have since added the Adler Business System and Osborne portable computers. Manager Steve Colman, a businessman for over 20 years, has recently been joined by Phil Enever who brings with him considerable experience in mainframe computer applications.

"Both of us believe that micro computers will become as necessary to the businessman as telephones or calculators," says Steve Colman. "The fact that we are not computer whizz-kids but down-to-earth practical businessmen should give our clients the confidence they need working out their requirement."

The shop is currently running a series of free seminars on program packages for specific trades, professions and businesses. For more information contact Computers Galore, 99 Military Rd, Neutral Bay, NSW 2089 (02) 908 2355.

More Apple software

Electronic Concepts Pty Ltd, sole distributors of Apple computers in Australia, has announced a range of new software for the Apple II.

For educational users, Apple "Superpilot" is now available to help teachers in schools and industry to create lessons and illustrations for computer-aided instruction. Superpilot offers all the facilities of the earlier Apple Pilot plus added features for enhanced graphics, easy debugging and computer control of videodisc and videotape players.

Also announced are two support products, Co-Pilot and Superpilot Log. Co-Pilot is an interactive self-paced tutorial on Apple Pilot, while the Superpilot Log works with Superpilot as a record keeping program that automatically keeps track of test scores by item, student or class.

Superpilot requires an Apple II or Apple II plus computer with 64K of RAM.

For the Apple III, Microsoft Corporation has released "Softcard" (TM) a Z80 processor board which plugs into one of the internal expansion slots and allows the computer to run CP/M based programs.

Documents on demand from Anacom printer



The new Anacom model 160 and 160Z dot matrix printers extends the Anacom range to eight models. The Anacom 160 uses a unique paper drive mechanism which pulls the paper up through the machine to the print head. This arrangement means that the full height of forms is available for printing and enables the use of heavy, multipart forms, labels, invoices and cheques without adjustment of the tractor feed.

The high mounting position of the print head combined with the paper feed mechanism means that forms can be printed to within 1.3mm of the perforations. There is no need to reposition the paper or remove the paper from the drive mechanism when detaching forms. It is claimed that the Anacom 160 virtually pays for itself with the forms, paper and labels it saves.

A heavy duty print mechanism,

rated at 150 characters per second and a nine wire dot matrix print head, good for 300 million characters are further features of the Anacom 160 models. Bi-directional printing, serial or parallel interface and 80 or 132 column printer carriages are also available.

The Anacom 160Z offers more features, with a choice of six character sizes, dot addressable graphics, correspondence quality printing (with double striking of the dot matrix characters) and a 4K byte buffer memory. Four character sets, including a user programmable set, allows for foreign languages (Arabic and Greek, for example) and mathematical and scientific symbols.

For more information on the Anacom 160 printers, contact the Australian distributor, Paris Radio Electronics, Shop 1, 165 Bunnerong Rd, Kingsford, NSW 2032.

New 64K bit chip organised as 16Kx4

An announcement from Texas Instruments Inc points out a disadvantage of the 64K x 1-bit Random Access Memory chips being increasingly used in computer systems. Dynamic RAM chips are currently organised to supply one bit of data for each of 65,000 memory locations. To set up a 64K by 8-bit memory thus requires eight of the chips.

The problem is that using 64K x 1 chips the smallest amount of memory that can be provided is, of course, 64K. Many systems, however, may only require 16K

of memory.

To answer this problem Texas Instruments has introduced a 64K bit RAM chip which is organised as 16,000 4-bit memory locations. Two of the new TMS4416 chips thus provide 16K of 8-bit dynamic RAM. Normally eight 16K x 1 chips would be used for this requirement.

Other advantages of the new design include a higher data rate (more bits per second) and lower power dissipation than "x1" configurations.

SPHERE COMPUTERS



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AN ADVANCED SYSTEM BASED ON THE 6809 MICROPROCESSOR

- * EFFICIENT
- * VERSATILE
- * EXCELLENT SUPPORT
- * SUPERB SOFTWARE
- * MK2 MULTI USER AND MULTI TASKING

MK 1 and MK 2 SPECIFICATIONS

PROCESSOR
The heart of the system is the Motorola 6809 CPU and considered to be the most powerful 8 bit Microprocessor available today. The CPU board is fitted with Memory Management hardware which allows it to directly address up to 1 Megabyte of memory using a 20 Bit ad-

dress bus. The system is provided with a 2716 compatible 2k Monitor ROM or EPROM.

MEMORY

A 64K Ram board is provided as standard. However the system may be provided with as little as 8k if desired and more added later.



POWER SUPPLY
Provides 8.5V, +12V, -12V unregulated supply to the buss. All components are P.C. board mounted and fuses readily accessible.

PERIPHERALS

Additional VDU's, Dot Matrix Printers, Daisy Wheel Printers, 8" and 5" Floppy Disk Systems; and a hard disk drive of up to 40MB may be connected to the system. Interface boards and software are available to support all these devices in a singular or multi-user environment.

INPUT/OUTPUT

8 I/O Boards slots are provided, each of which may be fitted with a dual serial or dual parallel interface board using DB-25 "D-TYPE" Connectors. Many other types of interface Boards are also available.

CABINET

The Cabinet is made of heavy gauge (approx 1/8") Aluminium Anodised in Delightful blue.

SIZE

Approx: 16" wide by 20" deep by 7.5" high.

WEIGHT

Approx. 10KG. (including supply, CPU, 64K RAM, and I/O board).
AC POWER INPUT 115-240 VOLTS AC
+/- 10%, 50-60Hz.

SOFTWARE SPECIALIST FOR THE 68XX SERIES

MICROWARE SYSTEM CORP

OS-9 Level 1 Operating System	\$195.00
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Assembler	\$ 95.00
Debugger	\$ 35.00
Stylograph Word Processor	\$175.00
Cobol Programming Language	\$995.00
C Programming Language	\$440.00

TECHNICAL SYSTEMS CONSULTANTS

UNIFlex Operating System	\$550.00
UNIFlex Basic	\$200.00
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General Purpose Flex 6809	\$165.00
General Purpose Flex 6800	\$165.00
Exorcisor Flex 6809	\$165.00
SWTPC Flex 6809	\$ 45.00
GIMIX Flex 6809	\$ 99.00
TRS80C Colour Flex	\$ POA
Extended Basic	\$110.00
Utilities	\$ 82.50
Pascal for Flex	\$220.00
68000 Cross Assembler for Flex	\$275.00

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Text Editor	\$ 55.00
Assembler	\$ 55.00
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Diagnostics	\$ 82.50
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Password Protection Pack	\$ 99.00
Dynasoft Pascal Flex	\$ 99.00
Bill Payer System	\$185.00
Spell Test	\$220.00
Super Sleuth	\$110.00
Stylograph 2.0	\$325.00
Dynastar Full Screen Editor OS-9, Flex	\$ 99.00
CRASMB Cross Assembler, Flex, 6809, 6800, Z80, 8080, 6502	\$149.00
Dataman + DBM	\$220.00
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WASHINGTON COMPUTER SERVICES

6809RMS DBM for Flex	\$220.00
6809 RMS DBM for UNIFlex	\$330.00
6809 RMS DBM for OS-9	\$275.00

UNIVERSAL DATA RESEARCH INC

DBM 2 Flex	\$450.00
DBM 2 UNIFlex	\$550.00
Payroll	\$495.00
Accts Receivable	\$495.00
Accts Payable	\$495.00
General Ledger	\$495.00
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COMPUTER SYSTEM CENTRE

DYNAMITE Dissassembler	\$ 66.00
DYNACALC	POA

DUGGERS GROWING SYSTEMS

6809 C Compiler ver 2.0	\$130.00
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OMEGASOFT PRODUCTS

PCS2 Pascal Compiler Flex, OS-9, MDOS	\$490.00
Rail1 Relocatable Assembler & Linking Loader	\$150.00

SWTPC

EDIT Word Processing Editor Flex	\$110.00
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C Compiler for UNIFlex	\$ POA
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* Prices subject to alteration without notice, \$5 handling and packaging plus postage.

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MELBOURNE, VIC 3000

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Microcomputer News

New address for Paris Radio Electronics

Paris Radio Electronics, distributors of 6809 systems and software, has moved to a new office and showroom at Shop 1, 165 Bunnerong Rd, Kingsford, telephone (02) 344 9111. The postal address is unchanged at PO Box 380, Darlinghurst, NSW 2010.

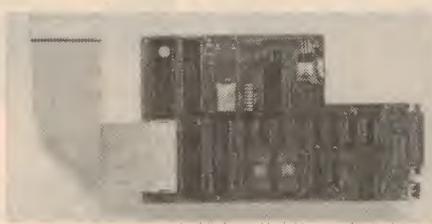
Paris Radio Electronics are the authorised distributors for Sphere, Gimix Inc and South West Technical Products Corporation microprocessor systems and probably Australia's largest supplier of software for 6800, 6809 and 68000 processors. Packages are available to run under the three most popular operating systems, Flex(tm), OS-9 (tm) and Uniflex (tm). In addition a wide range of books and magazines are available, including a new United States publication, "System-68" magazine. The first issue contains articles on DMA for the 6800, a comparison of 68000 and 6809 microprocessors, disk diagnostics and CRT terminal controllers, among others.

For further information contact Paris Radio Electronics at the address above.

Interface board for Olympia typewriter

Those looking for an economical printing computer terminal now have the option of converting the Olympia ES100 typewriter with an interface board from SME Systems.

SME, who designed the typewriter conversion boards, has been manufacturing them exclusively for Olympia for the past two years. Now the company is offering the boards with manual and fitting instructions to the public for \$240.



Mike Pratt, Managing Director of SME, says that his company's conversion hardware and software has made the Olympia one of the most versatile typewriters on the market.

"With the board, the Olympia ES100 is also a word processing quality printer and a stand-alone hard copy computer terminal."

In both functions the typewriter with conversion board is compatible with any

computer that uses RS232C communication protocols.

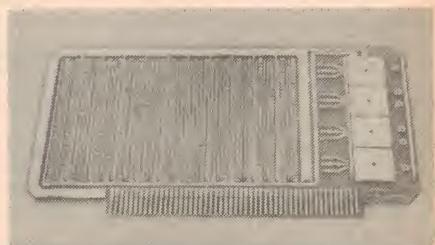
"As a terminal it can communicate via a modem with any computer system, a handy tool for the professional and small businessman who finds it difficult to justify the expense of a 'dumb terminal' that may only be used infrequently," Mr Pratt adds.

When not communicating with a computer system the ES100 can still be used as a typewriter.

According to Mr Pratt, virtually any typewriter owner can fit the board in less than 20 minutes, although SME will do the installation for an additional charge.

For more information contact SME Systems, 22 Queen St, Mitcham, Vic 3132.

Dick Smith Electronics S-100 prototyping board



Dick Smith Electronics now has available a new wire-wrap prototyping printed circuit board for S-100 systems. The board, H-8850, is ideal for experimenters, custom interfaces and computer circuits.

It is a standard size S-100 board, double-sided but not plated through, with tinned tracks for easy soldering. The edge connector is gold-flashed, and the board includes space and mounting holes for four 3-terminal regulators.

The board costs \$25 and is available from all Dick Smith stores and resellers.

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NOW AVAILABLE

64K Dynamic RAM, Dual Drives
and Green Screen

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Dealer for:
Peach, OKI & Fairlight

Eurocard modules from Rank Electronics

Thorn-EMI has appointed Rank Electronics as its Australian distributor of the Thorn-EMI range of Eurocard microprocessor modules.

The boards are designed and manufactured in South Australia.

Eurocards are available using 8-bit Motorola microprocessors, including the 6800, 6802 and 6809. Other modules include ROM, RAM, digital I/O, communications boards and peripheral controllers. All boards conform to the standard Eurocard size (100mm x 160mm) and use the standard edge connector format.

For further information contact Rank Electronics, 19 Trent St, Burwood, Vic 3125, or your local Rank Electronics sales office.

HOBBYISTS . . . BARGAIN BASEMENT . . . OVER STOCKS, MISTAKES, END OF LINES . . . YOU REAP THE BENEFIT!

TELL TIME & TEMP!

Build yourself a clock that doubles as a thermometer ... or build yourself a thermometer that doubles as a clock! Superb module does it all for you. Pre-assembled-ready to build in. Huge 18mm digits - visible for miles! Cat Y-1053.

\$22.50 WAS \$34.50*
SAVE \$12!

Full technical data sheet supplied with each module!

OR A COMPLETE KIT?

Complete kit also available: includes case, power supply, etc. Full assembly instructions supplied too! **\$49.50**

RED FACES DEPT

Boy are we embarrassed!

Someone added a zero to an order — and we're overstocked! These superb folded aluminum cases were made to take our CDI — but they're just as useful for any small project AND A BONUS! They're already drilled to take couple of 2N3055's! Hurry — while stocks last! Cat H-3107

Measures 170(w) x 125(d) x 55(h) mm



\$3.67

Introducing the Dick Smith

The Video Entertainment system with computer capability*



Cat. Y-1600

★ Great range of games — Sonic Invaders, Auto Chase, Planet Defender and many more!

★ 'Nasa' type hand controllers with 16 positions and qwerty keyboard.

★ High resolution graphics — tighter matrix gives much better picture quality — you'll appreciate the difference.

★ Latest technology — other TV consoles were designed 2 or even 3 years ago — a lifetime in electronics.

*Available soon: BASIC cartridge, simply plug in & your Wizard is now your own personal computer. Watch our ads for availability.

AND IT'S ONLY **\$295.00**

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WATCH THIS SPACE EACH MONTH FOR DETAILS OF OUR EXCITING MONTHLY SPECIAL . . . SAVE A FORTUNE OVER NORMAL PRICES . . . AVAILABLE FROM ANY OF OUR STORES OR MAIL ORDER CENTRE!

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Just the thing for blackouts — or for the glovebox, etc. 3 way light, fluoro lamp, spot lamp or emergency flasher. With heavy duty web carrying strap. Top value at normal price and now look!

Cat Y-1084 WAS \$14.95



NOW HALF PRICE

\$7.50

SUPERB TOOLS AT HOBBYIST PRICES

SIDE CUTTING PLIER

Made of sturdy gummated with a polished finish & insulated handles. Flat serrated jaws with built cutting edge. Has the edge on the others! Cat T-3270

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0.47	35	R-4715	15	16	R-4755
1.0	35	R-4720	22	16	R-4760
1.5	35	R-4725	33	10	R-4765
2.2	35	R-4730	47	6.3	R-4770
3.3	35	R-4735	100	3	R-4775

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Into amateur religion? Then you need the 'Bible' of amateur radio — the superb 1982 ARRL Handbook. All the latest details & updated electrical laws & circuits section. A MUST! Cat. B-2219



\$19.95

YOU JUST BOUGHT A PERSONAL WHAT?

Takes you into the exciting & creative world of Microsoft Level II BASIC. You learn as you program! Even explains hardware peripherals that can be added to your computer for greater versatility! Cat. B-2331



\$15.95

INTRODUCTION TO WORD PROCESSING

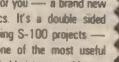
Shows you what a word processor is, what it does, how to use one, how to choose one & MUCH MORE! Cat. B-2346



\$13.95

NEW S-100 PROTOTYPER

Experimenting with computers? This one's for you — a brand new design, exclusive to Dick Smith Electronics. It's a double-sided fiberglass PCB especially made for prototyping S-100 projects — like custom interfaces for example. It's one of the most useful development tools any designer — or even hobbyist — could own. It features gold flashed edge connectors for incredible reliability and life: tinned conductors for easy soldering, supply rail buses to all IC positions and spaces on board for up to 4 TO-220 regulators. IDEAL FOR ANY S-100 MICROCOMPUTER! Cat. H-8850



ONLY '25.00

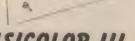
ELECTROS AT NEAR WHOLESALE PRICES!!!

Value in uF	Volt.	Cat. No.	Price	Price
0.47	63	R-4010	2.95	25¢
1.0	350	R-4015	3.00	25¢
2.2	63	R-4020	3.00	25¢
2.5	25	R-4025	3.00	25¢
3.3	63	R-4030	3.00	25¢
4.7	500	R-4045	6.00	55¢
8	500	R-4050	8.00	80¢
10	16	R-4060	3.00	25¢
10	25	R-4065	3.00	25¢
16	500	R-4070	\$1.15	\$1.10
24	500	R-4080	\$1.15	\$1.10
25	25	R-4085	3.00	25¢
25	63	R-4090	3.50	33¢
33	500	R-4100	\$1.50	\$1.30
47	16	R-4105	3.00	25¢
47	25	R-4110	3.00	25¢
47	63	R-4115	4.00	35¢
47	350	R-4120	\$1.30	\$1.10
100	10	R-4125	4.00	35¢
100	25	R-4130	4.00	35¢
100	63	R-4140	\$0.90	1.60
220	16	R-4145	5.00	50¢
220	25	R-4150	9.00	80¢
220	63	R-4155	9.00	80¢
470	16	R-4160	8.00	75¢
470	63	R-4165	\$1.30	\$1.00
640	16	R-4170	8.00	75¢
1000	16	R-4175	9.50	85¢
1000	25	R-4180	\$1.10	\$1.00
1000	35	R-4185	\$1.30	\$1.20
1000	63	R-4190	\$1.75	\$1.55
2500	16	R-4195	\$1.20	\$1.10
2500	25	R-4200	\$1.70	\$1.50
2500	35	R-4205	\$1.95	\$1.80
2500	60	R-4210	\$2.40	\$2.30
4700	35	R-4215	\$2.75	\$2.55
SINGLE ENDED (PCB MOUNTING)				
2.2	25	R-4300	2.0c	18¢
4.7	25	R-4310	2.0c	18¢
10	25	R-4315	2.2c	19¢
25	25	R-4320	2.4c	22¢
33	10	R-4330	2.4c	22¢
33	35	R-4342	2.8c	23¢
47	25	R-4350	2.8c	23¢
100	16	R-4360	2.8c	23¢
220	16	R-4380	6.00	55¢
220	25	R-4390	7.0c	65¢
330	25	R-4400	7.5c	67¢
47	16	R-4410	6.3c	55¢
470	25	R-4420	7.5c	65¢
640	16	R-4430	7.5c	65¢
1000	16	R-4440	8.0c	75¢
2500	25	R-4450	8.0c	70¢
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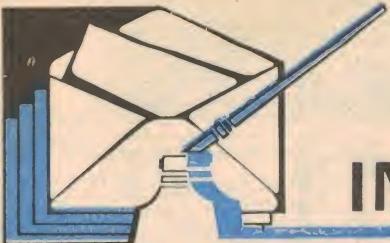
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INFORMATION CENTRE

NAKAMICHI 482: I wish to enquire about claims made in an article in August 1980 edition of your magazine. It concerns the Nakamichi 482 cassette deck. It stated in the article that "Few decks can match it in performance, regardless of price"; on what specifications and in relation to what type decks in particular was this statement based? If it is possible, could the various specifications be sent to my address concerning the tape decks as there is disagreement among my work colleagues as to the accuracy of this claim.

The specifications of the tape decks concerned would be of great assistance. (H. de G., Rotorua, NZ.)

● The claim made for this deck was a generalisation which we believed to be correct at the time and still have no reason to doubt. The particular specifications highlighted in the review were the frequency response curves of the various tapes, particularly at high signal levels. Naturally, the situation has changed since then but the Nakamichi 482 would still be a very nice machine to own. Unfortunately, we are not in a position to provide a detailed comparison between the Nakamichi and its contemporary competitors.

AUTOTRANSFORMER: This is in regard to the item of page 61 of the April '82 issue. For small changes in voltage, the current available from the new secondary terminals is approximately equal to the rated current of the windings originally intended to be used as a secondary.

Auto transformers should not be used to lower the mains voltage by more than 25% unless they are an integral part of the equipment. (See SAA Code AS 3000 1981 section 4.28.4 for other restrictions placed on the use of auto transformers).

Two transformers selected at random did not have their terminals marked "Start" and "Finish" as shown in the diagram. This could pose a problem for some readers. Best wishes. (Anonymous).

● Thank you for your comments although why are you so coy about signing your name? As far as identifying the transformer connection is concerned, the reader should measure the output voltage of the "autotransformer" before connecting it to the equipment.

PLAYMASTER MOSFET STEREO AMPLIFIER: I have built the Playmaster Mosfet Stereo Amplifier. Everything set up as per instructions and sounds very nice. I would like to know how hot the heatsink should get, under no signal conditions. The heatsink in mine gets unbearably hot, when turned on and not operating. (M.R., Mildura, Vic.)

● Under no signal conditions the heatsink does become quite warm or even hot, depending on the ambient temperature. However, your description suggests that the quiescent current is too high or perhaps the amplifier is oscillating supersonically and thus dissipating more power than it should.

TRAFFIC INDICATOR: I have been prompted to make this request by the failure of another of the commercially available indicate flasher units. Has there been, and if not would it be possible to publish a circuit for automobile indicator unit?

I have seen circuits that are good for cars and for add ons for trailer repeaters. I do not have the knowledge to combine them. The unit needs to include a facility for "low" voltage off mode that keeps the filament hot but not "on". This I understand prolongs the bulb life. Also needed is a repeater section for trailer connection.

There may be need for isolating the rear lamps so that the reversing lights do not feed power back into the circuit, when they are on, as most reversing lights seem to operate on the rear turn lamps.

Another query, in the computer columns I read about machines using BASIC under varying types, Microsoft BASIC, SuperBASIC and Microworld BASIC, etc. Now are these various types ways around copyright or are they a way of ensuring that a user only has access to one or two sources of software?

I must add that I enjoy the magazine greatly and have had fun with some of the novelty projects. I had some nice compliments on building the flashing Christmas tree. (C. B. Girrawheen, WA).

● We have not devoted any thought to this as a possible project but it does have quite a few requirements. For a start, as you have noted, when the lamp is flashing, it does not turn off but is maintained at "red heat" between flashes. We

are not sure whether this is mainly to extend bulb life or the life of the switching contacts, but it could probably be easily incorporated into a transistor circuit. Naturally, the circuit must also provide audible indication that it is functioning.

Also required would be some means of indicating bulb failure. The present electro-mechanical indicators do this well by cycling much faster if a bulb fails. And finally, a "hazard" flasher function must be provided. When you add all this up, the conventional mechanical doohickey does the job very well. But we will have a think about an electronic version.

As far as the different versions of Basic are concerned, these are usually interpreter programs written to suit the particular hardware and specifically the microprocessor used in a computer. Partly, some of these Basic interpreters have also been written to avoid paying royalties to another company. As you have guessed this does restrict the access to software unless the user has sufficient programming skills to transfer program features from one Basic program to another. As someone said, "Life wasn't . . ."

110V POWER SUPPLY: I would like to know if you have published a circuit diagram of a unit to replace a 240V-110V stepdown transformer. This would probably use a Triac and would have overload protection.

I would like to know also if there is any truth in the statement that a power Triac can be used as an output stage of an amplifier. If so, how about publishing the circuit? (D.H., San Miguel, Manila.)

● Yes, back in February 1972 we did publish a circuit to give a regulated 110V RMS output from a mains input voltage range of 160 to 260 volts RMS. The circuit used just three semiconductors, a Diac, Triac and a silicon bilateral switch, plus a few passive components. It was intended to run a 110V photographic enlarger and would probably be not suitable for running a TV set, as you envisage. However it would be suitable for any resistive load, with a power rating to suit the Triac used.

Concerning a Triac used in an audio amplifier stage, it may be possible but it certainly would not be a practical circuit as Triacs are normally intended for

regenerative switching applications at frequencies of 400Hz and below. Just how they could be used in linear mode we are not sure. Nor would we bother. However, we wonder if this statement arises from the use of Triacs as an output "crowbar" in some Japanese amplifiers of about 10 years ago.

In this mode, they were connected directly across the audio output of each channel. Then, if there was a mishap and one of the output transistors failed, a large DC voltage would appear across the speaker. This would be detected by the Triac driver circuitry and the Triac would immediately turn to on to short out the DC condition and thus protect the speaker. This would inevitably destroy the other output transistor which meant that usually all the output transistors would have to be replaced.

At the time, the thinking was that it was cheaper to replace output transistors than to repair an expensive loudspeaker system. Nowadays, relay protection is normally used to disconnect the speakers in the case of a DC fault and no further damage is caused to the power amplifiers.

LOUDSPEAKER DESIGN: I have read the articles published in August, September and December 1981 on loudspeaker design with great interest. I learnt much on correct vented speaker design and take this opportunity to compliment you on a well delivered series which finally gives the facts on a previously vague subject.

I am particularly interested in applying the procedure to multiple identical drivers. Unfortunately this aspect has not been covered. For example, if two identical drivers were to be used in a single enclosure, does Vas double and Q remain the same? (M.L., Mulgrave, Vic.)

● In your example, Vas doubles and Q is the figure for a single driver. The net effect is that, for a given bass frequency alignment, the enclosure volume will be double that required for a single driver.

HOT CASSETTE DECK: I recently purchased a cassette deck and have noticed that it runs at an unusually high temperature when playing or recording. After 90 minutes of use, the temperature sits at around 45°C. The manufacturers claim that this is acceptable. I believe these temperatures are too high and that constant use of this deck will adversely affect my much valued collection. (B.B., Naremburn, NSW.)

● We agree that your deck does seem to be quite warm but we do not think it is likely to lead to any damage. After all, 45°C is quite cool compared to the temperatures that can be found in a closed car and which can cause physical distortion of cassette mouldings. We would also point out that typical videocassettes become quite warm after

Bracing Loudspeaker Enclosures:

PLAYMASTER 3-70L: I am writing in reference to your Playmaster 3-70L loudspeaker project, and wish to point out a few things which should vastly improve the sound quality of these units.

Firstly I must agree with you regarding the importance of cabinet sealing. These units must be sealed totally, otherwise sound degradation will result. One area which often escapes the notice of the home constructor is the speaker terminals. The best terminals to use are the "binding post" type which offer both bare wire and banana plug facilities.

It is with disappointment that I have to report that the kit enclosures available with the 3-70L system, as supplied, are not really the same quality as the electrical components, although they do have improvement potential provided the home constructor is prepared to put some extra effort into his project. While the finish is excellent the completed box is rather resonant and provides its own colouration to the overall sound. This, of course, becomes worse as volume is increased and the more power fed to the woofer the more the cabinet "walls" will vibrate.

The simplest solution to this problem

would be to stuff as much Innerbond wool into the enclosure as humanly possible, after cabinet construction and crossover mounting, and before mounting of the drive units.

The ultimate solution to the resonance problem would be to purchase only the electrical components and construct the cabinets from scratch from a heavier duty chipboard than that used in the kits. This offers the advantage of being able to vary the size (but not the internal volume) of the cabinets. However, this would probably be beyond many of us (including me) and the end result would not look nearly as good as the kit cabinets. Keep up the good work. (S.J., Artarmon, NSW).

● We do not agree with the idea of overstuffing the enclosure with Innerbond to control cabinet resonances. This would have the effect of increasing the woofer resonance unduly and thus raising the cutoff frequency. If as you say, the panels tend to resonate, internal bracing should be added. Alternatively, lining in the form of bituminous felt or the "anti-drum" damping used in automobiles could be added to the inside of the panels.

an hour or so of use but this is regarded as normal.

STEAM WHISTLE: Concerning model railways perhaps your next steam whistle project could include some or all of the following.

In the July 1954 issue of Victoria Railways Newsletter the following is found - "of the standard steam whistle (as fitted to the R and other classes) the tones of the five chime whistle are fundamental, major third, perfect fifth, major seventh and octave. These correspond at the lower boiler pressures to the A major seventh chord. Four of these tones together give the pleasing common chord but, by adding G sharp, a

dissonant challenging effect is produced which says in unmistakeable terms, "get off the line".

The May 1981 Model Railroader circuit used a top octave generator and analog switch but is not analog in operation. Also an audio delay line (Polyback 92CU5 161) was used to introduce an amount of reverberation. The original unmixed waveforms probably need also to be rich in harmonics and phase shifts to simulate the rough casting effect which made all steam whistles sound the same yet all that little bit different.

Perhaps something like this plus white noise may be interesting. The challenge, of course, being to build a control rope

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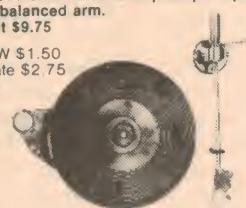
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which can progressively modulate the chord in tone and volume and finally adds the dissonant component when fully extended in an analog fashion rather than suddenly "switched in".

In other words the attack/decay times, the basic chord tone, the volume level and some components of the chord all need to be controlled by pulling the rope softly to a "hard-on" position.

From the gentle mellow tones across the plains to the piercing shriek of the fast heavy freights racing for the grade, all are variations of the one whistle. Most drivers, became adept at ringing the beautiful chimes across the country in those glorious days of steam. (M.R., Ringwood, Vic.)

● Cheez. Have we gotta do all that just for a steam whistle? Can't you get one turned up in brass and run it with a little air compressor? Joking aside, we remember a motor driven toy some years back that had quite a realistic steam whistle sound. No doubt it is possible to synthesise the steam whistle sound you desire but we suspect that it would be quite a complicated circuit.

SLIDE SHOW: I have a problem with a Slide Show Cross-fader (EA November 1981) unit built from a kit; basically it is that the slide changer is triggered before the globes have faded completely.

The output at pin 10 of IC6c swings consistently between 1.4V and 8.6V, and would trip the Schmitt trigger only to on. Supply voltages are correct at the pins of IC6.

Suspecting a faulty IC, I purchased a replacement from a different supplier and fitted it, this time with a socket. But again there was absolutely no difference in the voltages and performance of the circuit. A slight reduction in the hysteresis of IC6b allows triggering of both relays, but the overall effect is that the changer operates before complete fade-out and is quite visible.

I first checked the back to back diodes at the ramp generation stage and found the forward voltages of both to read rather low — roughly 0.4V rather than 0.6 as specified. However, increasing the gain of IC6c had no effect on the maximum and minimum output voltages which I gather should be much closer to the rails.

Both ICs used were identical in appearance, carrying the full ident: RC4136DB, RAYC8048 and RAYC8102. I would be grateful if you could suggest where the trouble may lie. (N.Y., Sth Yarra, Vic.)

● Altering the hysteresis of IC6a, as you have done, may be the solution to the fault. To obtain better results, try adjusting the 120kΩ resistor connected from the non-inverting input to the output of IC6b with a 50kΩ trimpot in series with the resistor. Adjust the trimpot until

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a satisfactory changeover point occurs. If this is still not satisfactory, then an extra delay can be incorporated into the circuitry to prevent the slide change occurring until a preset time after the Schmitt trigger, IC6b, changes. A 470μF capacitor connected from the base of the BC557 transistor relay drivers to ground should provide a suitable 0.5 second delay.

The output swings that you obtain from IC6c are less than would be expected from a typical 4136 op amp. Increasing the gain, however, will not affect the voltage swings, even though the diode drops are only 0.4V. This is because the amplifier has a gain of eleven which is sufficient to accommodate a low diode drop.

LCD CAPACITANCE METER: I have run into trouble with your latest capacitance meter using the liquid crystal module. Everything works fine except the pF range. This only reads approximately true reading, viz 1000pF reads 350pF. The 50kΩ multturn pot will only alter this about 7pF yet it will alter the high range (20μF) by 7μF. Circuit and soldering have been double checked. Even the 10MΩ resistor has been replaced by an imported 0.1% job. I am at a loss, can you help? (7555 also replaced.) (R.L., Merimbula, NSW.)

● As the fault with the meter reading only appears when you switch to the pF range, the fault must lie in something that is switched in only on this range. As you have already replaced the 10MΩ resistor, we suggest that you check the switch contacts very carefully with an ohm meter. An alternative to measuring the contact resistance is to temporarily solder a wire link across the pF position of the switch. This will short out the switch and the capacitance meter should read correctly.

From your letter it is not clear which 50kΩ pot you are adjusting — we assume that it must be the offset pot. The variations in display readings quoted (7pF on the 2000pF range and 7μF on the 20μF range) are not correct. The offset pot provides a DC offset that should affect all ranges by an equal percentage amount; ie, it should adjust the 20μF range by 7μF and the 2000pF range by 700pF. If the offset voltage were incorrectly adjusted it could cause the meter to read 350pF instead of 1000pF, but this should also affect the 200nF and 20μF ranges, causing them to read low as well.

When working correctly the offset control should be able to reduce the displayed reading to around -1150 on the pF range (with the minus annunciator connected). If the range of adjustment is much less than this, a 4.7MΩ resistor may have been fitted in series with the offset pot rather than a 470kΩ resistor. One last thing worth checking is whether the metal inserts in the banana sockets on the front panel are completely insulated from the Scotchcal label. If not, stray capacitance from the Scotchcal could influence readings on the pF range.

Notes & Errata

12/230V INVERTER: (June 1982, File 3/IT/12); The overlay diagram on page 42 contains two errors. Firstly the SCR is shown to be incorrectly oriented. The K and G connections should be transposed. The photograph on page 47 shows the correct orientation. Secondly, the 0.47μF tantalum capacitor connected to the pin 5 of IC7, is also shown incorrectly oriented. The circuit diagram is correct.

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Regional Shopping Centre,
Melton 3338.
Telephone 743 1011.

Sunbury Printed Circuits,
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MacDougal Road,
Sunbury 3429.
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WA
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N.Z.
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Avondale, Auckland.

Mini Tech Manufacturing
Co Ltd,
PO Box 9194,
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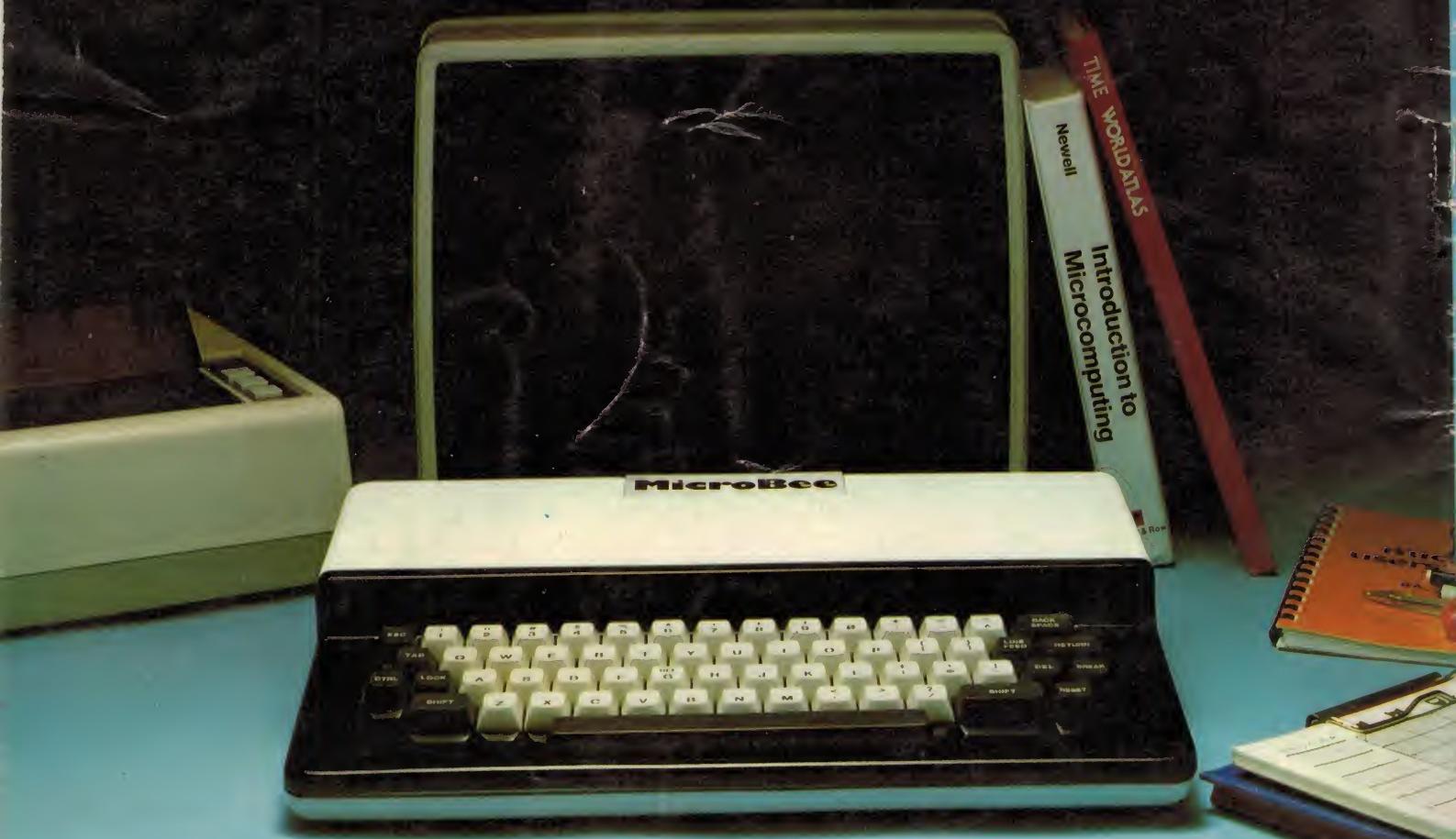
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